National Park Service
U.S. Department of the Interior

Cape Lookout National Seashore
North Carolina

CAPE LOOKOUT
NATIONAL SEASHORE

Personal Watercraft Use
Environmental Assessment

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Personal Watercraft Use Environmental Assessment

December 2004

SUMMARY

Cape Lookout National Seashore was established by Congress in 1966 to conserve and preserve for public use and enjoyment the outstanding natural, cultural, and recreational values of a dynamic coastal barrier island environment for future generations. Cape Lookout National Seashore is located three miles off the mainland coast in the central coastal area of North Carolina and occupies more than 29,000 acres of land and water from Ocracoke Inlet on the northeast to Beaufort Inlet to the southwest. The national seashore consists of four main barrier islands (North Core Banks, Middle Core Banks, South Core Banks, and Shackleford Banks), which consist mostly of wide, bare beaches with low dunes covered by scattered grasses, flat grasslands bordered by dense vegetation, and large expanses of salt marsh alongside the sound. There are no road connections to the mainland or between the islands.

The purpose of and the need for taking action is to evaluate a range of alternatives and strategies for the management of personal watercraft (PWC) use at Cape Lookout National Seashore in order to ensure the protection of park resources and values while offering recreational opportunities as provided for in the national seashore's enabling legislation, purpose, mission, and goals. Upon completion of the *National Environmental Policy Act* (NEPA) process, the National Park Service (NPS) may either take action to adopt special regulations to re-institute PWC use at Cape Lookout National Seashore, or it may permanently close this park unit to PWC use.

BACKGROUND

More than one million personal watercraft (PWC) are estimated to be in operation today in the United States. Sometimes referred to as "jet skis" or "wet bikes," these use conventional two-stroke engines powering a water jet pump as its primary source of propulsion. They are used for enjoyment, particularly for touring and maneuvers such as wave jumping, and they are capable of speeds in the 60-mph range.

After studies in Everglades National Park showed that PWC use resulted in damage to vegetation, adversely impacted shorebirds, and disturbed the life cycles of other wildlife, the NPS prohibited PWC use by a special regulation at the park in 1994. In recognition of its duties under its Organic Act and *NPS Management Policies 2001* (NPS 2001d), as well as increased awareness and public controversy about PWC use, the NPS subsequently reevaluated its methods of PWC regulation. Historically, the National Park Service had grouped personal watercraft with all vessels; thus, PWC was allowed when the unit's Superintendent's Compendium allowed the use of other vessels. Later, the NPS closed seven units to PWC use through the implementation of horsepower restrictions, general management plan revisions, and park-specific regulations, such as those promulgated by Everglades National Park.

In May 1998, the Bluewater Network filed a petition urging the NPS to initiate a rulemaking process to prohibit PWC use throughout the national park system. In response to the petition, the NPS issued an interim management policy requiring superintendents of parks where PWC use can occur but had not yet occurred to close the unit to such use until the rule was finalized. The NPS envisioned the servicewide regulation as an opportunity to evaluate impacts from PWC use before authorizing the use. On March 21, 2000, the NPS issued a regulation prohibiting PWC use in most units and required 21 units to determine the appropriateness of continued PWC use.

In response to the PWC final regulation, Bluewater Network sued the NPS, challenging the NPS decision to allow continued PWC use in 21 units while prohibiting PWC use in other units. In response to the suit, the NPS and the environmental group negotiated a settlement. Each park desiring to continue long-term PWC use must promulgate a park-specific special regulation in 2002. In addition, the settlement stipulates that the NPS must base its decision to issue a park-specific special regulation to continue PWC use on an

environmental analysis conducted in accordance with NEPA. The NEPA analysis at a minimum, according to the settlement, must evaluate PWC impacts on water quality, air quality, soundscapes, wildlife, wildlife habitat, shoreline vegetation, visitor conflicts, and visitor safety.

Cape Lookout was first closed to PWC use in March of 2001 through the Superintendent's Compendium. However, the PWC closure was rescinded in April 2001 by the Secretary of Interior. Between April 2001 and April 2002, the park was open to PWC use. On April 22, 2002, PWC were prohibited from park waters, per the settlement agreement, until the completion of this environmental analysis and a decision is made whether to seek a park-specific regulation to allow PWC use.

ALTERNATIVES CONSIDERED

This environmental assessment evaluates three alternatives concerning the use of PWC at Cape Lookout National Seashore. The alternatives considered include:

- *No-Action Alternative*: Do not reinstate PWC use within the national seashore. No special regulation would be promulgated.

- *Alternative A*: Reinstate PWC use as previously managed under a special regulation.

- *Alternative B*: Reinstate PWC use under a special NPS regulation with additional management prescriptions.

Based on the analysis prepared for PWC use at Cape Lookout National Seashore, alternative B is considered the environmentally preferred alternative by best fulfilling park responsibilities as trustee of sensitive habitat; by ensuring safe, healthful, productive, and aesthetically and culturally pleasing surroundings; and by attaining a wider range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences.

ENVIRONMENTAL CONSEQUENCES

Impacts of the three PWC management alternatives were assessed in accordance with *Director's Order #12: Conservation Planning, Environmental Impact Analysis and Decision-Making* (NPS 2001c). The *Director's Order #12 Handbook* requires that impacts on park resources be analyzed in terms of their context, duration, and intensity. It is crucial for the public and decision-makers to understand the implications of those impacts in the short and long-term, cumulatively, and within context, based on an understanding and interpretation by resource professionals and specialists.

To determine impacts, methodologies were identified to measure the change in park resources that would occur with the implementation of the PWC management alternatives. Thresholds were established for each impact topic to help understand the severity and magnitude of changes in resource conditions, both adverse and beneficial.

Each PWC management alternative was compared to a baseline to determine the context, duration, and intensity of resource impacts. The baseline, for purposes of impact analysis, is the continued prohibition of personal watercraft in Cape Lookout National Seashore (no-action alternative).

Table A summarizes the results of the impact analysis for the impact topics that were assessed in the "Environmental Consequences" chapter. The analysis considered a 10-year period (2003–2013).

TABLE A: SUMMARY OF THE IMPACT ANALYSIS

Impact Topic	No-Action Alternative: Continue Prohibition of PWC Use in Cape Lookout National Seashore	Alternative A: Reinstate PWC Use under a Special NPS Regulation as Previously Managed	Alternative B: Reinstate PWC Use under a Special NPS Regulation with Additional Management Prescriptions (Preferred Alternative)
Water Quality	PWC use impacts: No impacts on water quality of park waters. Cumulative impacts: Other motorized vessels would continue to have negligible adverse impacts on Cape Lookout's water quality due to their discharge of organic pollutants.	PWC use impacts: Negligible impacts for all pollutants in all areas in both 2003 and 2013. Cumulative impacts: Negligible impacts for all pollutants in all areas in 2003 and 2013. In 2013, cumulative water quality impacts from watercraft are expected to be lower than in 2003 due to U.S. Environmental Protection Agency (EPA) reduced emission rates.	PWC use impacts: Same as alternative A. Cumulative impacts: Same as alternative A.
Impact to Human Health from Airborne Pollutants Related to PWC Use	PWC use impacts: No impacts on human health for PWC related CO, PM_{10}, HC, and NO_x emissions for both 2003 and 2013. Cumulative impacts: Negligible impacts for CO, HC, PM_{10} and NO_x. Slightly increased NO_x emissions in 2013 would result from increased boating activity and consideration of the conversion to new technology engines.	PWC use impacts: Negligible adverse impacts on human health related to the PWC airborne pollutants CO, PM_{10}, HC, and NO_x for the year 2003. The risk from PAH would also be negligible. In 2013 there would be increases in CO, PM_{10}, HC, and NO_x emissions, and the impact level for these pollutants would remain negligible, the same as in 2003. Cumulative impacts: Negligible adverse impacts on existing air quality conditions, with future reductions in PM_{10} and HC emissions due to EPA requirements for improved emission controls. PWC emissions of HC are estimated to be less than 1% of the cumulative boating emissions in 2003 and 2013. Contributions from land-based sources of air emissions would likely be negligible.	PWC use impacts: Same as alternative A, but the additional management prescriptions would slightly reduce PWC emissions as compared with alternative A. Negligible adverse impacts from PWC emissions for CO, PM_{10}, HC, and NO_x would occur in 2003 and 2013. The risk from PAH would also be negligible in 2003 and 2013. Cumulative impacts: Same as alternative A.
Air Quality Related Values from PWC Pollutants	PWC use impacts: No impacts on air quality related values from PWC in both 2003 and 2013. Cumulative impacts: Negligible long-term adverse impacts on air quality related values from all watercraft in 2003 and 2013.	PWC use impacts: Negligible adverse impacts on air quality related values from PWC use would occur in both 2003 and 2013. Cumulative impacts: Negligible adverse impacts from cumulative emissions from motorized boats and PWC would occur in both 2003 and 2013.	PWC use impacts: Same as alternative A. Cumulative impacts: Same as alternative A.
Soundscapes	PWC use impacts: No impacts on soundscapes at the national seashore, and no contribution to noise impacts from PWC within national seashore boundaries. Cumulative impacts: Short-term, negligible to minor, and adverse, concentrated particularly on the western end of Shackleford Banks and the Cape Lookout area on the south end of South Core Banks.	PWC use impacts: Adverse, short-term, and negligible to moderate. Impacts would be negligible where use is infrequent and where visitation is low, and moderate in more congested areas. Cumulative impacts: Adverse, short-term, and negligible to moderate given the historically low numbers of PWC use and the high numbers of motorized boats.	PWC use impacts: Adverse, short-term, negligible to minor impacts, depending on location. Cumulative impacts: Adverse, short-term, and negligible to minor, depending on location.

Impact Topic	No-Action Alternative: Continue Prohibition of PWC Use in Cape Lookout National Seashore	Alternative A: Reinstate PWC Use under a Special NPS Regulation as Previously Managed	Alternative B: Reinstate PWC Use under a Special NPS Regulation with Additional Management Prescriptions (Preferred Alternative)
Shoreline and Submerged Aquatic Vegetation	PWC use impacts: No impacts on shoreline vegetation and submerged aquatic vegetation beds in park waters. Cumulative impacts: Adverse, direct and indirect, negligible to minor, and short- and long-term because most submerged aquatic vegetation beds could still be accessed, resulting in potential damage and loss of this habitat, as well as sediment resuspension and its effects. In addition, foot traffic would continue from other watercraft, causing negligible to minor indirect impact on shoreline vegetation.	PWC use impacts: Short-term, indirect, and minor Impacts on shoreline vegetation from foot traffic associated with PWC access to beach areas, and to marsh habitats from PWC use in shallow water habits Cumulative impacts: Minor impacts on shoreline vegetation and submerged aquatic vegetation habitats.	PWC use impacts: Negligible, indirect short-term impacts on submerged aquatic vegetation beds and negligible to minor short-term impacts on shoreline vegetation. Cumulative impacts: Minor, direct and indirect, short- and long-term impacts on shoreline vegetation and submerged aquatic vegetation beds.
Wildlife and Wildlife Habitats	PWC use impacts: No impacts on wildlife from PWC use within the national seashore boundary. Cumulative impacts: Negligible to minor, short-term adverse indirect impacts.	PWC use impacts: Short-term, minor, direct and indirect adverse impacts on terrestrial and aquatic wildlife species and habitats. Cumulative impacts: Short-term, minor, direct and indirect, and adverse.	PWC use impacts: Negligible to minor, short-term, adverse impacts on terrestrial and aquatic wildlife species and habitats. Cumulative impacts: Short-term, negligible to minor, direct and indirect, and adverse.
Aquatic Fauna	PWC use impacts: Adverse, minor, and short-term.	PWC use impacts: Adverse impacts on aquatic fauna due to noise.	PWC use impacts: Short-term, negligible, adverse impacts on aquatic fauna.
Threatened, Endangered, or Other Special Concern Species	PWC use impacts: No impacts from PWC use. Cumulative impacts: May affect but are not likely to adversely affect these species in park waters because of the slow travel speeds and short trip lengths and location of use.	PWC use impacts: May affect but is not likely to adversely affect manatees or whales in park waters, as these species are not present in areas or during seasons of peak PWC use. Cumulative impacts: May affect but is not likely to adversely affect sea turtles, Carolina diamondback terrapins, or special concern birds.	PWC use impacts: May affect but is not likely to adversely affect manatees or whales in park waters. Cumulative impacts: PWC and other motorized vessel use may affect but is not likely to adversely affect sea turtles or Carolina diamondback terrapins.
Visitor Use and Experience	PWC use impacts: No impacts on PWC or other national seashore Cumulative impacts: Cumulative impacts would be adverse, short-term, and moderate.	PWC use impacts: Beneficial impacts on PWC users, but adverse, short- and long-term impacts on most nonmotorized boat users. Other boaters would also experience adverse impacts of lesser intensity if they perceive PWC use as a compatible boating alternative. Impacts would range from negligible to moderate depending on location. Cumulative impacts: Adverse, short- and long-term, and moderate due to expected increases in visitation.	PWC use impacts: Beneficial impacts on PWC users, but adverse, short- and long-term impacts on other boaters (motorized and nonmotorized) ranging from negligible to moderate depending on location and type of boat use. Cumulative impacts: Adverse, short- and long-term, and negligible.
Visitor Conflicts and Safety	PWC use impacts: No impacts. Cumulative impacts: Adverse, long-term, and of varying intensity depending upon location	PWC use impacts: Adverse, short- and long-term ranging from negligible in the national seashore's north end to minor near the lighthouse. Cumulative impacts: Adverse, long-term and varying from negligible to moderate depending on location.	PWC use impacts: Adverse, short- and long-term impacts that would vary from negligible in low-use areas, to minor in localized, high-use areas Cumulative impacts: Adverse, long-term and vary from negligible to moderate depending on location.

Impact Topic	No-Action Alternative: Continue Prohibition of PWC Use in Cape Lookout National Seashore	Alternative A: Reinstate PWC Use under a Special NPS Regulation as Previously Managed	Alternative B: Reinstate PWC Use under a Special NPS Regulation with Additional Management Prescriptions (Preferred Alternative)
Cultural Resources	PWC use impacts: No impacts on archaeological and submerged sites. Cumulative impacts: Adverse cumulative impacts from illegal collecting, wave action from other boats, and wild horses would be long-term and negligible.	PWC use impacts: Adverse, long-term, negligible impacts. Cumulative impacts: Same as no-action.	PWC use impacts: Minimal impacts resulting from vandalism and illegal collecting. Cumulative impacts: Adverse, long-term, and negligible.
Socioeconomic Effects	There are no incremental benefits or costs associated with the no-action alternative.	Because PWC users account for a very small fraction of economic activity in the region, it is very unlikely that there will be any measurable incremental impacts on the regions' economy.	Same as alternative A.
Conflicts with State and Local Ordinances and Policies	PWC use impacts: No conflict with state PWC regulations; no impacts (including cumulative impacts) related to such conflicts.	PWC use impacts: No conflicts with state regulations; no impacts (including cumulative impacts) related to such conflicts.	PWC use impacts: No conflicts between state regulations; no impacts (including cumulative impacts) related to such conflicts.
Impact to Park Operations from Increased Enforcement Needs	PWC use impacts: No impacts on park management and operations.	PWC use impacts: Long-term, adverse, minor to moderate impacts on park management and operations.	PWC use impacts: Short-term, moderate adverse impacts on park operations.

CONTENTS

MAPS

TABLES

PURPOSE OF AND NEED FOR ACTION

INTRODUCTION

Cape Lookout National Seashore is located three miles off the mainland coast in the central coastal area of North Carolina and occupies more than 29,000 acres of land and water from Ocracoke Inlet on the northeast to Beaufort Inlet to the southwest. The national seashore consists of four main barrier islands (North Core Banks, Middle Core Banks, South Core Banks, and Shackleford Banks), which consist mostly of wide, bare beaches with low dunes covered by scattered grasses, flat grasslands bordered by dense vegetation, and large expanses of salt marsh alongside the sound. There are no road connections to the mainland or between the islands. Map 1 shows the location of the national seashore and the barrier islands.

More than one million personal watercraft (PWC)[1] are estimated to be in operation today in the United States. Sometimes referred to as "jet skis" or "wet bikes," these use conventional two-stroke engines powering a water jet pump as its primary source of propulsion. They are used for enjoyment, particularly for touring, and they are capable of speeds in the 60-mph range.

The National Park Service (NPS) maintains that PWC use emerged and gained popularity in park units before it could initiate and complete a "full evaluation of the possible impacts and ramifications." While PWC use remains a relatively new recreational activity, it has occurred in 32 of 87 park units that allow motorized boating.

The NPS first began to study PWC use in Everglades National Park. The studies showed that PWC use over emergent vegetation, shallow grass flats, and mud flats commonly used by feeding shorebirds damaged the vegetation, adversely impacted the shorebirds, and disturbed the life cycles of other wildlife. Consequently, managers at Everglades National Park determined that PWC use remained inconsistent with the resources, values, and purposes for which the park was established. In 1994 the NPS prohibited PWC use by a special regulation at the park (59 FR 58781).

Other public entities have taken steps to limit, and even to ban, PWC use in certain waterways as national researchers study more about the effects of PWC use. At least 34 states have either implemented or considered regulating PWC use and operation (63 FR 49314). Similarly, various federal agencies, including the Fish and Wildlife Service and the National Oceanic and Atmospheric Administration (NOAA), have managed PWC use differently than other classes of motorized watercraft.

Specifically, the National Oceanic and Atmospheric Administration regulates PWC use in most national marine sanctuaries. The regulation resulted in a court case where the Court of Appeals for the District of Columbia declared such PWC-specific management valid. In *Personal Watercraft Industry Association v. Department of Commerce*, 48 F.3d 540 (D. C. Cir. 1995), the court ruled that an agency can discriminate and manage one type of vessel (specifically PWC) differently than other vessels if the agency explains its reasons for the differentiation.

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1. Personal watercraft, as defined in 36 CFR 1.4(a) (2000), refers to a vessel, usually less than 16 feet in length, which uses an inboard, internal combustion engine powering a water jet pump as its primary source of propulsion. The vessel is intended to be operated by a person or persons sitting, standing, or kneeling on the vessel, rather than within the confines of the hull. The length is measured from end to end over the deck excluding sheer, meaning a straight line measurement of the overall length from the foremost part of the vessel to the aftermost part of the vessel, measured parallel to the centerline. Bow sprits, bumpkins, rudders, outboard motor brackets, and similar fittings or attachments, are not included in the measurement. Length is stated in feet and inches.

In February 1997 the Tahoe Regional Planning Agency (TRPA), the governing body charged with ensuring no derogation of Lake Tahoe's water quality, voted unanimously to ban all two-stroke, internal combustion engines, including PWC, because of their effects on water quality. Lake Tahoe's ban began in 2000.

In July 1998 the Washington State Supreme Court in *Weden v. San Juan County* (135 Wash. 2d 678 [1998]) found that the county had the authority to ban the use of PWC as a proper use of its police power in order to protect the public health, safety, or general welfare. Further, PWC are different from other vessels, and Washington counties have the authority to treat them differently.

In recognition of its duties under the *NPS Organic Act of 1916* and *NPS Management Policies 2001* (NPS 2001d), as well as increased awareness and public controversy, the NPS reevaluated its methods of PWC regulation. Historically, the NPS had grouped PWC with all vessels; thus, people could use such craft when the unit's Superintendent's Compendium allowed the use of other vessels. Later the Park Service closed seven units to PWC use through the implementation of horsepower restrictions, general management plan revisions, and park specific regulations such as those promulgated by Everglades National Park.

In May 1998 the Bluewater Network, a coalition of more than 70 organizations representing more than 4 million Americans, filed a petition urging the NPS to initiate a rule-making process to prohibit PWC use throughout the national park system. In response to the petition, the Park Service issued an interim management policy requiring superintendents of parks where PWC can occur but where it had never occurred to close the unit to such use until the rule was finalized. In addition, the NPS proposed a specific PWC regulation premised on the notion that PWC differ from conventional watercraft in terms of design, use, safety record, controversy, visitor impacts, resource impacts, horsepower to vessel length ratio, and thrust capacity (63 FR 49,312–17, Sept. 15, 1998).

The NPS envisioned the servicewide regulation as an opportunity to evaluate impacts from PWC use before authorizing the use. The preamble to the servicewide regulation calls the regulation a "conservative approach to managing PWC use" considering resource concerns, visitor conflicts, visitor enjoyment, and visitor safety. During a 60-day comment period, the NPS received approximately 20,000 comments.

As a result of public comments and further review, the NPS promulgated an amended regulation that prohibited PWC use in most units and required the remaining units to determine the appropriateness of continued PWC use (36 CFR 3.24(a), 2000; 65 FR 15,077–90, Mar. 21, 2000). Specifically, the regulation allowed the NPS to designate PWC use areas and to continue their use by promulgating a special regulation in 11 units, including Cape Lookout National Seashore, and by amending the units' Superintendents' Compendiums in 10 units (36 CFR 3.24(b), 2000). The NPS based the distinction between designation methods on the units' degree of motorized watercraft use.

In response to the PWC final regulation, Bluewater Network sued the NPS under the *Administrative Procedures Act* and the *NPS Organic Act of 1916*. The organization challenged NPS decision to allow continued PWC use in 21 units while prohibiting such use in other units. In addition, the organization disputed the NPS decision to allow 10 units to continue PWC use after 2002 by making entries in Superintendents' Compendiums, which would not require the opportunity for public input through a notice and comments on the rulemaking process. Further, the environmental group claimed that because PWC use causes water and air pollution, generates increased noise levels, and poses public safety threats, the NPS acted arbitrarily and capriciously when making the challenged decisions.

In response to the suit, the NPS and the environmental group negotiated a settlement. The resulting settlement agreement, signed by the judge on April 12, 2001, changed portions of the NPS PWC rule. While 21 units could continue PWC use in the short-term, each of those parks desiring to continue long-term PWC use must promulgate a park-specific special regulation in 2002. In addition, the settlement stipulates that the NPS must base its decision to issue a park-specific special regulation to continue PWC use through an environmental analysis conducted in accordance with the *National Environmental Policy Act* (NEPA). The NEPA analysis at a minimum, according to the settlement, must evaluate PWC impacts on water quality, air quality, soundscapes, wildlife, wildlife habitat, shoreline vegetation, visitor conflicts, and visitor safety.

In 2001 the NPS adopted its new management policy for PWC. The policy prohibits PWC use in national park system units unless their use remains appropriate for the specific park unit (*NPS Management Policies 2001,* sec. 8.2.3.3 [NPS 2001d]). The policy statement authorizes the use based on the park's enabling legislation, resources, values, other park uses, and overall management strategies.

As the settlement deadline approached and the park units were preparing to prohibit PWC use, the NPS, Congress, and PWC user groups sought legal methods to keep the parks open to this activity. However, no method was successful. On April 22, 2002, Cape Lookout National Seashore and the following units closed for PWC use: Assateague Island National Seashore; Big Thicket National Preserve; Pictured Rocks National Lakeshore; Fire Island National Seashore; and Gateway National Recreation Area. On September 15, 2002, eight other park units scheduled to close to PWC use included Amistad National Recreation Area.

Cape Lookout was first closed to PWC use in March of 2001 through the *Cape Lookout National Seashore: Superintendent's Compendium* (NPS 2001b). However, the PWC closure was rescinded in April 2001 by the Secretary of Interior. Between April 2001 and April 2002, the park was open to PWC use. On April 22, 2002, PWC were prohibited from park waters, per the settlement agreement, until the completion of this environmental analysis and a decision is made whether to seek a park-specific regulation to allow PWC use.

The proposed September 16, 2002, prohibition of PWC was averted with the execution of a stipulated modification to the settlement agreement. The modified settlement agreement was approved by the court on September 9, 2002, and extended unrestricted PWC use in some selected national park system units until November 6, 2002. Park units that prepare an environmental assessment to analyze PWC use alternatives and then select an alternative to continue such use will have to draft a special regulation to authorize that use in the future.

On March 28, 2002, the Personal Watercraft Industry Association (PWIA) filed suit against the NPS for its final PWC regulation, challenging its discrimination between PWC and other vessels and the NPS decision to close units without conducting an environmental analysis. The PWIA requested the court enjoin the NPS from implementing the ban on PWC use effective April 22, 2002. The court refused to enjoin the ban.

PURPOSE OF AND NEED FOR ACTION

The purpose of and the need for taking action is to evaluate a range of alternatives and strategies for the management of PWC use at Cape Lookout National Seashore in order to ensure the protection of park resources and values while offering recreational opportunities as provided for in the national seashore's enabling legislation, purpose, mission, and goals. Upon completion of the NEPA process, the NPS may

either take action to adopt special regulations to re-institute PWC use at Cape Lookout National Seashore, or it may permanently close this park unit to PWC use, as allowed for in the NPS March 2000 rule.

This environmental assessment evaluates three alternatives concerning the use of PWC at Cape Lookout National Seashore. The alternatives considered include:

- *No-Action Alternative*: Do not reinstate PWC use within the national seashore. No special regulation would be promulgated.
- *Alternative A*: Reinstate PWC use as previously managed under a special regulation.
- *Alternative B*: Reinstate PWC use under a special NPS regulation with additional management prescriptions.

SCOPE OF THE ANALYSIS

Motorboats and other watercraft have been in use at Cape Lookout National Seashore since the park was established in 1966. It is unknown when PWC use first began at the national seashore. While some effects of PWC use are similar to other motorcraft and therefore difficult to distinguish, the focus of this action is in support of decisions and rulemaking specific to PWC use. However, while the settlement agreement and need for action have defined the scope of this environmental assessment, NEPA requires an analysis of cumulative effects on resources of all past, present, and reasonably foreseeable actions when added to the effects of the proposal (40 CFR 1508.7, 2000). The scope of this analysis, therefore, is to define management alternatives specific to PWC use, in consideration of other uses, actions, and activities cumulatively affecting park resources and values.

PURPOSE AND SIGNIFICANCE OF CAPE LOOKOUT NATIONAL SEASHORE

National park system units were established by Congress to fulfill specified purposes, based on each area's unique and "significant" resources. A park's purpose, as established by Congress, is the fundamental building block for its decisions to conserve resources while providing for "enjoyment of future generations."

Cape Lookout National Seashore was authorized on March 10, 1966, by Public Law 89-366. Additional mandatory legislation, Public Law 93-477 (October 26, 1974), called for another 232-acre tract of land to be acquired, a review and recommendation of any suitable lands for wilderness designation, and authorized funding for land acquisition and essential public facilities.

The following mission, purpose, and significance statements are derived from this legislation and are excerpts from the park's *Cape Lookout National Seashore: Five-Year Strategic Plan* (*Strategic Plan* [NPS 2000c]). The strategic plan is consistent with the 1982 General Management Plan and subsequent amendments.

MISSION OF CAPE LOOKOUT NATIONAL SEASHORE

The mission of Cape Lookout National Seashore is to:

- conserve and preserve for the future the outstanding natural resources of a dynamic coastal barrier island system;
- protect and interpret the significant cultural resources of past and contemporary maritime history;
- provide for public education and enrichment through proactive interpretation and scientific study; and
- provide for sustainable use of recreation resources and opportunities.

PURPOSE OF CAPE LOOKOUT NATIONAL SEASHORE

The purpose of Cape Lookout National Seashore is to conserve and preserve for public use and enjoyment the outstanding natural, cultural, and recreational values of a dynamic coastal barrier island environment for future generations. The national seashore serves as both a refuge for wildlife and a pleasuring ground for the public, including developed visitor amenities.

SIGNIFICANCE OF CAPE LOOKOUT NATIONAL SEASHORE

Cape Lookout National Seashore is nationally recognized as an outstanding example of a dynamic natural coastal barrier island system. Cape Lookout is designated as a unit of the Carolinian-South Atlantic Biosphere Reserve, United Nations Educational, Scientific and Cultural Organizations (UNESCO) Man and the Biosphere Reserve Program. The park contains:

- cultural resources rich in the maritime history of humankind's attempt to survive at the edge of the sea; and
- critical habitat for endangered and threatened species and other unique wildlife including the legislatively protected wild horses of Shackleford Banks.

The park also represents a conscious change in the human use and development of the islands.

BACKGROUND

NPS ORGANIC ACT AND MANAGEMENT POLICIES

By enacting the *NPS Organic Act of 1916*, Congress directed the NPS to manage units under its jurisdiction “to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations” (16 USC 1). Congress reiterated this mandate in the *Redwood National Park Expansion Act of 1978* by stating that the NPS must conduct its actions in a manner that will ensure no “derogation of the values and purposes for which these various areas have been

established, except as may have been or shall be directly and specifically provided by Congress" (16 USC 1 a-1).

Despite these mandates, the *NPS Organic Act of 1916* and its amendments afford the NPS latitude when making resource decisions that balance visitor recreation and resource preservation. By these acts Congress "empowered [the NPS] with the authority to determine what uses of park resources are proper and what proportion of the parks resources are available for each use" (*Bicycle Trails Council of Marin v. Babbitt*, 82 F.3d 1445, 1453 [9th Cir. 1996]).

Yet, courts have consistently interpreted the *NPS Organic Act of 1916* and its amendments to elevate resource conservation above visitor recreation. *Michigan United Conservation Clubs v. Lujan*, 949 F.2d 202, 206 (6th Cir. 1991) states, "Congress placed specific emphasis on conservation." The *National Rifle Ass'n of America v. Potter*, 628 F.Supp. 903, 909 (D.D.C. 1986) states, "In the Organic Act Congress speaks of but a single purpose, namely, conservation." The *NPS Management Policies 2001* also recognize that resource conservation takes precedence over visitor recreation. The policy dictates "when there is a conflict between conserving resources and values and providing for enjoyment of them, conservation is to be predominant" (*NPS Management Policies 2001,* sec. 1.4.3 [NPS 2001d]).

Because conservation remains predominant, the NPS seeks to avoid or to minimize adverse impacts on park resources and values. Yet, the Park Service has discretion to allow negative impacts when necessary (*NPS Management Policies 2001,* sec. 1.4.3 [NPS 2001d]). While some actions and activities cause impacts, the NPS cannot allow an adverse impact that constitutes a resource impairment (*NPS Management Policies 2001,* sec. 1.4.3[NPS 2001d]). The *NPS Organic Act of 1916* prohibits actions that permanently impair park resources unless a law directly and specifically allows for the acts (16 USC 1 a-1). An action constitutes an impairment when its impacts "harm the integrity of park resources or values, including the opportunities that otherwise would be present for the enjoyment of those resources or values" (*NPS Management Policies 2001,* sec. 1.4.4 [NPS 2001d]). To determine impairment, the NPS must evaluate "the particular resources and values that would be affected; the severity, duration, and timing of the impact; the direct and indirect effects of the impact; and the cumulative effects of the impact in question and other impacts" (*NPS Management Policies 2001,* sec. 1.4.4 [NPS 2001d]).

Because park units vary based on their enabling legislation, natural resources, cultural resources, and missions, the recreational activities appropriate for each unit and for areas within each unit vary as well. An action appropriate in one unit could impair resources in another unit. Thus, this environmental assessment analyzes the context, duration, and intensity of impacts related to PWC use at Cape Lookout National Seashore, as well as potential for resource impairment, as required by *Director's Order #12: Conservation Planning, Environmental Impact Analysis, and Decision-making* (NPS 2001c).

SUMMARY OF NATIONAL RESEARCH ON THE EFFECTS OF PERSONAL WATERCRAFT

Over the past two decades PWC use in the United States increased. However, there are conflicting data about whether PWC use is continuing to increase. While the National Transportation Safety Board (NTSB) estimates that retailers sell approximately 200,000 PWC each year and people currently use another 1 million (NTSB 1998); the PWC industry argues that PWC sales have decreased by 50% from 1995 to 2000 (American Watercraft Association [AWA] 2001). National PWC ownership increased every year between 1991 and 1998; the annual change in ownership peaked in 1994 at 32% and dropped to below zero in 1999, 2000, and 2001, indicating a decrease in PWC ownership in recent years (table 1).

TABLE 1: NATIONAL PWC REGISTRATION TREND*

Year	No. of Boats Owned	No. of PWC Owned	Boat Ownership Trend (Percentage Change)	PWC Ownership Trend (Percentage Change)
1991	16,262,000	305,915	—	—
1992	16,262,000	372,283	0%	21.7%
1993	16,212,000	454,545	0%	22.1%
1994	16,239,000	600,000	0%	32.0%
1995	15,375,000	760,000	-5%	26.7%
1996	15,830,000	900,000	3%	18.4%
1997	16,230,000	1,000,000	3%	11.1%
1998	16,657,000	1,100,000	3%	10.0%
1999	16,773,000	1,096,000	1%	-0.4%
2000	16,965,000	1,078,400	1%	-1.6%
2001		1,053,560		-2.4%

Source: M. Schmidt, USCG, email comm., September 4, 2001; National Marine Manufacturers Association (NMMA) 2002.

* Estimates provided by the National Marine Manufacturers Association (M. Schmidt, USCG, pers. comm. 9/4/2001).

Multiple studies have demonstrated that four-stroke engines are substantially cleaner than carbureted, two-stroke engines, generating approximately 90% fewer emissions (Warrington 1999; TRPA 1999). A typical conventional (i.e., carbureted) two-stroke PWC engine discharges as much as 30% of its fuel unburned directly into the water (NPS 1999; California Air Resources Board [CARB] 1999). At common fuel consumption rates, an average two-hour ride on a PWC may discharge 3 gallons of fuel into the water (NPS 1999). According to data from the CARB, two-stroke PWC engines may consume 5 to 10 gallons of fuel per hour, of which up to 3.3 gallons per hour may be discharged unburned (CARB 1998). (As described in appendix A, an estimated discharge rate of 3 gallons per hour is used in the water quality impact calculations.)

PWIA notes that direct-injection engines have been available in PWC for four years; and three PWC manufacturers introduced four-stroke engines for the 2002 model year (PWIA 2002a). The U.S. Environmental Protection Agency (EPA) assumes that the existing two-stroke engine models would not be completely replaced by newer PWC technology until 2050 (EPA 1997). PWIA believes that through the 2002 model year, the output on a limited number of higher rated models was between 155 and 165 hp (PWIA 2002b).

The average operating life of a PWC is 5 to 10 years, depending upon the source. The formula for determining the operating life of PWC was published in the *Federal Register* on October 4, 1996 (EPA 1996a). Based on this formula, the NPS expects that by 2012, most boat owners will already be in compliance with the 2006 EPA marine engine standards. The PWIA believes the typical operating life of a PWC rental is 3 years and approximately 5 to 7 years for a privately owned vessel (PWIA 2002a).

Environmental groups, PWC users and manufacturers, and land managers express differing opinions about the environmental consequences of PWC use, and about the need to manage or to limit this recreational activity. Research conducted on the effects of PWC use is summarized below for water pollution, air pollution, noise, wildlife, vegetation and shoreline erosion, and health and safety.

Water Pollution

The majority of PWC in use today are powered by conventional two-stroke, carbureted engines that discharge as much as 30% of their fuel directly into the water (NPS 1999; CARB 1999). Hydrocarbons, including benzene, toluene, ethyl benzene, and xylene (BTEX) and polycyclic aromatic hydrocarbons (PAH), are released, as well as methyl tertiary-butyl ether (MTBE) in states that use this additive. The amount of pollution correctly attributed to PWC use compared to other motorboats and the degree to which PWC use affects water quality remains debatable. As noted in a report by the Oregon Department of Environmental Quality (ODEQ), every waterbody has different conditions (e.g., water temperature, air temperatures, water mixing, motorboating use, and winds) that affect the pollutants' impacts (ODEQ 1999).

PAH stands for polycyclic aromatic hydrocarbons. PAHs, including benzo(a)pyrene, naphthalene, and 1-methyl maphthalene, are released during the combustion of fuel, though some PAHs are also found in unburned gasoline. PAH, as well as other hydrocarbon emissions into the water, could potentially be reduced as new four-stroke engines replace older carbureted two-stroke engines (Kado et al. 2000). The conversion of carbureted two-stroke engines would be an important step toward substantially reducing petroleum related pollutants.

Discharges of MTBE and PAH particularly concern scientists because of their potential to adversely affect the health of people and aquatic organisms. Scientists need to conduct additional studies on PAH (Allen et al. 1998) and on MTBE (NPS 1999), as well as long-term studies on the effect of repeated exposure to low levels of these pollutants (Asplund 2001).

A recent study conducted by the CARB consisted of a laboratory test designed to comparatively evaluate exhaust emissions from marine and PWC engines, in particular two- and four-stroke engines (CARB 2001). The results of this study showed a difference in emission (in some cases 10 times higher total hydrocarbons in two-stroke engines) between these two types of engines. An exception was air emissions of NO_x which were higher in four-stroke than in two-stroke engines. Concentrations of pollutants (MTBE, BTEX) in the tested water were consistently higher for two-stroke engines.

In 1996, the EPA promulgated a rule to control exhaust emissions from new marine engines, including outboards and PWC. Emission controls provide for increasingly stricter standards beginning in model year 1999 (EPA 1996a, 1997). In 1996, the EPA estimated an overall 52% reduction in hydrocarbon emissions in water from marine engines from present levels by 2010, and a 75% reduction by 2030, based on replacement of polluting machines with cleaner models. The 1997 EPA rule delayed implementation by one year (EPA 1996a, 1997).

At Lake Tahoe concern about the negative impact on lake water quality and aquatic life caused by the use of two-stroke marine engines led to at least 10 different studies relevant to motorized watercraft in the Tahoe Basin in 1997 and 1998. The results of these studies (Allen et al. 1998) confirmed that (1) petroleum products are in the lakes as a result of motorized watercraft operation, and (2) watercraft powered by carbureted two-stroke engines discharge pollutants at an order of magnitude greater than do watercraft powered by newer technology engines (TRPA 1999).

On June 25, 1997, the TRPA adopted an ordinance prohibiting the “discharge of unburned fuel and oil from the operation of watercraft propelled by carbureted two-stroke engines” beginning June 1, 1999. Following the release of an environmental assessment in January 1999, this prohibition was made permanent.

A recent study by the TRPA (2003) compared the concentrations of PAH compounds released into the water and found that the two-stroke carbureted outboard engine emitted lower PAH levels into the water than did the two-stroke direct-injected engine. The four-stroke carbureted outboard engine emitted the lowest PAH levels, as well as other gasoline-related contaminants into the water (TRPA 2003; CARB 2001). However, the two-stroke carbureted outboard engine emitted higher levels of benzene than the two-stroke direct-injected engine model (CARB 2001). PWC engines follow the same patterns of emission rates as outboard (CARB 2001). The TRPA (2003) study confirms other findings regarding emissions into the water and does not substantially change NPS conclusions regarding water quality impacts.

Air Pollution

Two-stroke engines that have been conventionally used in PWC emit pollutants such as NO_x and VOCs that may adversely affect air quality. In areas with high PWC use some air quality degradation likely occurs (EPA 1996a, 2000). Kado et al. (2000) found that two-stroke engines had considerably higher emissions of airborne particulates and PAH than four-stroke engines tested. It is assumed that the 1996 EPA rule concerning marine engines will substantially reduce air emissions from PWC in the future (EPA 1996a).

PWC emit various compounds that pollute the air. In the two-stroke engines commonly used in PWC, the lubricating oil is used once and is expelled as part of the exhaust; and the combustion process results in emissions of air pollutants such as VOCs, NO_x, PM, and CO.

Low-emissions engines, including both four-stroke engines and direct-injection two-stroke engines, generate reduced amounts of most air pollutants, including CO, PM, hydrocarbons, and VOC. However, the low-emission engines produce more NO_x than do carbureted two-stroke engines (EPA 1996a) and the two-stroke direct-injected engine has been shown to generate more airborne-particulate PAH emissions, a class of VOCs, than the two-stroke carbureted engines (Kado et al. 2000). Further research is needed to identify what impact this would have on PAH concentration in water. The EPA estimates that conversion to four-stroke engines and two-stroke direct injection will both result in an increase in the level of NO_x produced by PWC engines. In order to meet stringent hydrocarbon emission reduction contained in the EPA final rule, EPA estimates that manufacturers will need to recalibrate their engines to run at leaner air-fuel ratios, resulting in higher combustion temperatures, more complete combustion, and some increase in nitrogen oxide formation. In addition, conversion to two-stroke direct inject and four-stroke technology have little internal exhaust gas recirculation which could reduce emission rates of nitrogen oxides (EPA 1996a). In August 2002, EPA proposed additional rules that would further reduce boating emissions. The proposal includes evaporative emission standards for all boats and would reduce emissions from fuel tanks, etc., by 80% (67 FR 157, August 14, 2002, pp. 53049-53115).

Noise

PWC-generated noise varies from vessel to vessel. No literature was found that definitively described scientific measurements of PWC noise. Some literature stated that all recently manufactured watercraft emit fewer than 80 decibels (dB) at 50 feet from the vessel, while other sources attributed levels as high as 102 dB without specifying distance. None of this literature fully described the method used to collect noise data.

The NPS contracted for noise measurements of PWC and other motorized vessels in 2001 at Glen Canyon National Recreation Area (Harris, Miller, Miller & Hanson, Inc. 2002). The results show that maximum

PWC noise levels at 25 meters (82 feet) ranged between 68 to 76 decibels on the A-weighted scale (dBA). Noise levels for other motorboat types measured during that study ranged from 65 to 77 dBA at 25 meters feet (82 feet). The larger boats, characterized as "V8 'muscle' boats", had noise levels of 85 to 86 dBA at 25 meters (82 feet). Noise limits established by the NPS require vessels to operate at less than 82 dB at 82 feet from the vessel.

PWC may be more disturbing than other motorized vessels because of rapid changes in acceleration and direction of noise. Noise impacts from PWC use are caused by a number of factors. Noise from human sources, including PWC, can intrude on natural soundscapes, masking the natural sounds that are an intrinsic part of the environment. This can be especially true in quiet places, such as in secluded lakes, coves, river corridors, and backwater areas. Also, PWC use in areas where there are nonmotorized users (such as canoeists, sailors, people fishing or picnicking, and kayakers) can disrupt the "passive" experience of park resources and values.

Komanoff and Shaw (2000) note that the biggest difference between noise from PWC and that from motorboats is that the former continually leave the water, which magnifies noise in two ways. Without the muffling effect of water, the engine noise is typically 15 dBA louder, and the smacking of the craft against the water surface results in a loud "whoop" or series of them. With the rapid maneuvering and frequent speed changes, the impeller has no constant "throughput" and no consistent load on the engine. Consequently, the engine speed rises and falls, resulting in a variable pitch. This constantly changing sound is often perceived as more disturbing than the constant sound from motorboats.

PWC users tend to operate close to shore, to operate in confined areas, and to travel in groups, making noise more noticeable to other recreationists. Motorboats traveling back and forth in one area at open throttle or spinning around in small inlets also generate complaints about noise levels; however, most motorboats tend to operate away from shore and to navigate in a straight line, thus being less noticeable to other recreationists (Vlasich 1998).

Research conducted by the Izaak Walton League (IWL) indicates that one PWC unit can emit between 85 and 105 dB of sound, and that wildlife or humans located 100 feet away may hear sounds of 75 dB. This study also stated that rapid changes in acceleration and direction may create a greater disturbance and emit sounds of up to 90 dB (IWL 1999). Other studies conducted by the New Jersey State Police indicate that a PWC unit with a 100-horsepower (hp) engine emits up to 76 dBA, while a single, 175-hp outboard engine emits up to 81 dBA. Sea-Doo research indicates that in three out of five distances measured during a sound level test, PWC engines were quieter than an outboard motorboat. Sea-Doo also found that it would take approximately four PWC units, 50 feet from the shore to produce 77 dBA, and it would take 16 PWC vessels operating at 15 feet from the shore to emit 83 dBA of sound, which is equal to one open exhaust boat at 1,600 feet from the shore. In response to public complaints, the PWC industry has employed new technologies to reduce sound by about 50% to 70% on 1999 and newer models (Sea-Doo 2000; Hayes 2002). Additionally, by 2006 the EPA requirements will reduce PWC noise, in association with improvements to engine technology (EPA 1996b). EPA research also indicated that one PWC unit operating 50 feet from an onshore observer emits a sound level of 71 dBA, and studies conducted using the Society of Automotive Engineers (SAE [2001]) found that two PWC units operating 50 feet from the shore emit similar sound levels of about 74 dBA (PWIA 2000).

Most studies on the effects of noise on soundscapes and human receptors have focused on highway and airport noise. Komanoff and Shaw (2000) used the analytical approaches of these studies to perform a noise-cost analysis of PWC. They concluded that the cost to beachgoers from PWC noise was more than $900 million per year. The cost per PWC was estimated to be about $700 per vessel each year or $47 for each 3-hour "PWC day." They concluded that the cost per beachgoer was the highest at secluded lake sites, where beachgoers had a higher expectation of experiencing natural quiet and usually invested a

larger amount of time and personal energy in reaching the area. However, because there are many more visitors to be affected at popular beaches, noise costs per PWC were highest at crowded sites (*Drowning in Noise: Noise Costs of Jet Skis in America* [Komanoff and Shaw 2000]).

Wildlife Impacts

Although relatively few studies have specifically examined PWC effects on wildlife, several researchers have documented wildlife disturbances from PWC and motorboats. A study recently completed in Florida examined the distance at which waterbirds are disturbed by both PWC and outboard-powered boats (Rodgers and Schwikert 2002). Flush distances varied from 65 to 160 feet for PWC, and flush distances for most species were greater for motorboats than for PWC 80% of the time. The authors note that PWC use may be more threatening to waterbirds since PWC users can navigate in shallow secluded waterways where birds typically eat and rest. Burger (2000) examined the behavior of common terns in relation to PWC use and other boats and noted that PWC users traveled faster and came closer to banks, resulting in more flight response in terns and contributing to lower reproductive success.

Shoreline Vegetation

The effects of PWC use on aquatic communities have not been fully studied, and scientists disagree about whether PWC use adversely impacts aquatic vegetation. The majority of concern arises from the shallow draft of PWC, which allows access to shallow areas that conventional motorboats cannot reach. Like other vessels, PWC may destroy grasses that occur in shallow water ecosystems. Anderson (2000) studied the effect of PWC wave-wash on shallow salt marsh vegetation and found that although the waves from PWC are not different from those generated by other boats, PWC can enter marsh channels and create sediment suspension problems in these areas.

Erosion Effects

Some studies have examined the erosion effects of PWC waves, and other studies suggest that PWC may disturb sediments on river or lake bottoms and cause turbidity. Conflicting research exists concerning whether PWC-caused waves result in erosion and sedimentation. PWC-generated waves vary in size depending on the environment, including weight of the driver, number of passengers, and speed. As noted above, Anderson (2000) studied the effect of PWC wave-wash on shallow salt marsh vegetation and found that although the waves from PWC are not different from those generated by other boats, PWC can enter marsh channels and create sediment suspension problems in these areas.

Health and Safety Concerns

Industry representatives report that PWC accidents decreased in some states in the late 1990s. The NTSB reported that in 1996 PWC represented 7.5% of state-registered recreational boats but accounted for 36% of recreational boating accidents. In the same year, PWC operators accounted for more than 41% of people injured in boating accidents. PWC operators accounted for approximately 85% of the persons injured in accidents studied in 1997 (NTSB 1998). Since PWC operators can be as young as 12 in several states, accidents can involve children. The American Academy of Pediatrics (2000) recommends that no one younger than 16 operate PWC.

Increased PWC use in recent years has resulted in more concern about the health and safety of operators, swimmers, snorkelers, divers, and other boaters. A 1998 NTSB study revealed that while recreational boating fatalities have been declining in recent years, PWC-related fatalities have increased (NTSB 1998). Nationwide PWC accident statistics provided by the U.S. Coast Guard supports the increase in PWC-related fatalities (table 2). However, since a peak of 84 PWC-related fatalities in 1997, accidents, injuries, and fatalities involving PWC have decreased (M. Schmidt, U.S. Coast Guard [USCG], pers. comm. 9/4/2001). The U.S. Coast Guard's Office of Boating Safety studied exposure data to assess boating risks. This method allows for a comparison between boat types based on comparable time in the water. PWC use ranked second in boat type for fatalities per million hours of exposure in 1998, with a 0.24 death rate per million exposure hours.

For example, on more recent models, Sea-Doo developed an off-power assisted steering system that helps steer during off-power as well as off-throttle situations. This system, according to company literature, is designed to provide additional maneuverability and improve the rate of deceleration (Sea-Doo 2001a).

PWC USE AND REGULATION AT CAPE LOOKOUT NATIONAL SEASHORE

In compliance with the settlement with the Bluewater Network, the national seashore closed to PWC use in April 2002. PWC are prohibited from launching or landing on any lands, boat ramps or docks within the boundaries of the national seashore. PWCs may not be towed on trailers or carried on vehicles within national seashore boundaries except at the Harker's Island unit. This closure pertains to all of the barrier islands within the national seashore and the waters on the soundside of the islands within 150 feet of the mean low waterline. Outside of this boundary, PWC use is governed by North Carolina PWC regulations. At present, the areas that were previously used by PWC owners for landing are closed with signs. Thus, the following information represents PWC use patterns in the national seashore prior to the closure (*Cape Lookout National Seashore: Superintendent's Compendium* [NPS 2003b]).

TABLE 2: NATIONWIDE PWC ESTIMATES AND ACCIDENT STATISTICS[a]

Year	Recreational Boats Owned[a]	PWC Owned[1]	No. of PWC in Accidents	No. of PWC Injuries	No. of PWC Fatalities	No. of All Boats Involved in Accidents	Percentage of PWC Involved in Accidents
1987	14,515,000	N/A[b]	376	156	5	9,020	4.2
1988	15,093,000	N/A	650	254	20	8,981	7.2
1989	15,658,000	N/A	844	402	20	8,020	10.5
1990	15,987,000	N/A	1,162	532	28	8,591	13.5
1991	16,262,000	305,915	1,513	708	26	8,821	17.2
1992	16,262,000	372,283	1,650	730	34	8,206	20.1
1993	16,212,000	454,545	2,236	915	35	8,689	25.7
1994	16,239,000	600,000	3,002	1,338	56	9,722	30.9
1995	15,375,000	760,000	3,986	1,617	68	11,534	34.6
1996	15,830,000	900,000	4,099	1,837	57	11,306	36.3
1997	16,230,000	1,000,000	4,070	1,812	84	11,399	35.7
1998	16,657,000	1,100,000	3,607	1,743	78	11,368	31.7
1999	16,773,000	1,096,000	3,374	1,614	66	11,190	30.2
2000	16,965,000	1,078,400	3,282	1,580	68	11,079	29.6
Total			**33,851**	**15,238**	**645**		

Source: M. Schmidt, USCG, e-mail comm., Sept. 4, 2001.

a. Estimates provided by the National Marine Manufacturers Association (M. Schmidt, USCG, pers. comm. 9/4/2001).

b. N/A = not available.

Prior to the PWC closure, all areas of the park were open to PWC use. However, the majority of PWC use was concentrated in two national seashore areas that receive the heaviest visitor day-use in the park: (1) on the soundside of South Core Banks at the Lighthouse (from the Lighthouse dock through Barden Inlet and Lookout Bight), and (2) the soundside of Shackleford Banks from Wade Shores west to Beaufort Inlet. PWC use of ocean beaches was rare due to rough surf conditions in the ocean and the hazard of beaching PWC in the ocean surf. Some PWC use occurred along North and South Core Banks from Portsmouth Village at the northern end of the national seashore to the lighthouse. This use was infrequent because of the prevalence of marshes and lack of beaches along core banks, the large expanse of open water in Core Sound between the barrier islands and mainland North Carolina, and the low population of the adjacent communities in the "down east" as this portion of the national seashore is known locally. At public meetings held in October 2001, several participants indicated they had used their PWC to travel from locations such as Atlantic and Davis to the barrier islands.

The popularity of Cape Lookout and Shackleford Banks where PWC use was concentrated can be attributed to the excellent soundside beaches in these areas, the attraction of the Cape Lookout lighthouse, traditional use of Shackleford Banks, their proximity to major inlets, and their close proximity to the three largest coastal population centers in Carteret County: Atlantic Beach, Morehead City, and Beaufort. Should PWC use be reinstated at Cape Lookout National Seashore, park management has the authority to enable further restrictions if impacts dictate the need to do so.

OBJECTIVES IN TAKING ACTION

Objectives are "what must be achieved to a large degree for the action to be considered a success" (*Director's Order #12* [NPS 2001c]). All alternatives selected for detailed analysis must meet ALL objectives to a large degree and resolve purpose and need for action. Objectives for managing PWC use must be grounded in the national seashore's enabling legislation, purpose, significance, and mission goals, and be compatible with direction and guidance provided by the general management plan.

Water Quality

- Maintain the waters of Core Sound as High Quality Waters. Core Sound is classified by the North Carolina Department of Environment and Natural Resources, Division of Water Quality, as High Quality Waters, a classification intended to protect waters with quality higher than state water quality standards. Waters in Back and Core Sounds adjacent to Cape Lookout National Seashore are classified by North Carolina as having suitable water quality for shellfish harvesting. No waters surrounding Cape Lookout are under a fish consumption advisory, with the exception of the "no consumption" mercury advisory for large king mackerel along the southeast Atlantic coast (NCDHHS 2000).

- Protect plankton and other aquatic organisms from PWC emissions and sediment disturbances so that the viability of dependent species is conserved.

Air Quality

- Manage PWC activity so that air emissions of harmful compounds do not appreciably degrade ambient air quality.

Soundscapes

- Manage PWC use so that natural park soundscapes are infrequently affected by PWC noise in a minority of park acreage. PWC noise emissions are mostly confined to areas already experiencing noise from other non-natural sources.

- In areas of dense visitor use, manage PWC noise such that the noise emissions are comparatively no greater than noise emissions from other watercraft or other sources.

- Protect birds, waterfowl, and marine mammals from the effects of PWC noise, particularly during critical life stages.

Wildlife and Wildlife Habitat

- Protect the fish and wildlife species and habitats associated with the unique barrier island ecosystem found at Cape Lookout National Seashore, including those listed under the *Endangered Species Act* and similar statutes, from PWC disturbances that result in injury, changes in distribution and/or changes in population demographics.

- Protect fish and wildlife from the adverse effects that result from the bioaccumulation of contaminants emitted from PWC.

Shoreline and Submerged Aquatic Vegetation

- Manage PWC use to protect sensitive coastal island areas such as marshes, tidal flats, and submerged aquatic vegetation from PWC activity and access.

Visitor Conflict and Visitor Safety

- Minimize or reduce the potential for PWC user accidents.

- Minimize or reduce the potential for safety conflicts between PWC users and park visitors.

Visitor Experience

- Manage PWC use to minimize potential conflicts between PWC use and visitors and to prevent degradation of the visitor experience associated with an undeveloped, remote barrier island.

- Seek cooperation with local and state entities that manage or regulate PWC use in adjacent waters to minimize impacts on visitor experience within the park.

Cultural Resources

- Manage PWC use and access to protect cultural resources, including sacred sites important to Native Americans.

Socioeconomics

- Enhance communications with local communities regarding the management of PWC.

Cape Lookout National Seashore Management and Operations

- Minimize impacts on Cape Lookout National Seashore operations from increased enforcement needs.

- Seek cooperation with local and state entities that manage or regulate PWC use.

ISSUES RELATED TO PWC USE AT CAPE LOOKOUT NATIONAL SEASHORE

Issues associated with PWC use at Cape Lookout National Seashore were identified during scoping meetings with NPS staff at the park and as a result of public comments. Many of these issues were identified in the settlement agreement with the Bluewater Network, which requires that at a minimum the effects of PWC use be analyzed for the following: water quality, air quality, soundscapes, wildlife and wildlife habitat, shoreline vegetation, visitor conflicts and visitor safety. The following impact topics are discussed in the "Affected Environment" chapter and are analyzed in the "Environmental Consequences" chapter. If no impacts are expected, based on available information, then the issue was eliminated from further discussion, as discussed in the section "Issues Eliminated from Further Consideration," in this chapter.

WATER QUALITY

The majority of PWC in use today are still powered by conventional two-stroke, carbureted engines that discharge as much as 30% of their fuel directly into the water (NPS 1999; CARB 1999). Hydrocarbons, including BTEX and PAH, are released, as well as MTBE. These discharges have potential adverse effects on water quality. PWC use at Cape Lookout has previously occurred along the western 1/3 of Shackleford Banks (Beaufort Inlet) and in Lookout Bight where high tidal flushing occurs. Areas such as the Core Sound where very little flushing occurs were infrequently used by PWC.

Some research shows that PAH, including those from PWC emissions, adversely affect water quality via harmful phototoxic effects on ecologically sensitive plankton and other small water organisms (EPA 1998a; Oris et al. 1998; Landrum et al. 1987; Mekenyan et al. 1994; Arfsten et al. 1996). This in turn can affect aquatic life and ultimately aquatic food chains. The primary concern is in shallow water ecosystems. Currently at Cape Lookout National Seashore, there is known information regarding emissions and increased phototoxicity. Conversely, some PAHs may be degraded via photodegradation or microbial degradation (Fasnacht and Blough 2002; Albers 2002).

Multiple visitor uses, such as PWC use, boating, and swimming, occur in the same areas creating concerns that there could be human health effects related to PWC.

AIR QUALITY

Pollutant emissions, particularly nitrogen oxides and VOCs from PWC, may adversely affect air quality. These compounds react with sunlight to form ozone. To the extent that nitrogen loading in the air contributes to the nutrient loading in the water column, PWC use adversely affects water quality.

SOUNDSCAPES

All motorized watercraft at Cape Lookout, including PWC, produce noise that may impact park soundscapes and visitor experiences. Any watercraft that does not meet the NPS watercraft noise regulation of 82 dB at 82 feet at full acceleration is subject to fine and removal from the park. However, PWC may be more disturbing than other motorized vessels because of rapid changes in acceleration and direction of noise. PWC-generated noise may also be perceived as more intrusive in areas of natural quiet such as the Drum Inlets and Portsmouth Village, although use may be infrequent in those locations. Conversely, in more congested and heavily visited areas such as Shackleford Banks and Cape Lookout, visitors would have a greater chance of perceiving and being disturbed by the higher number of PWC that often occur in these visitor areas.

SHORELINE AND SUBMERGED AQUATIC VEGETATION

PWC users are able to access areas where most other motorcraft cannot go, which may disturb sensitive plant species. PWC and other watercraft are able to access areas such as tidal flats and marshes where sensitive vegetation and plant species exist.

Submerged aquatic vegetation is a diverse assembly of rooted macrophytes that grow in shallow water, under the surface, but not above it. These plants are beneficial to aquatic ecosystems because they provide a protective habitat for young and adult fish and shellfish, as well as food for waterfowl, fish, and mammals; and they aid in oxygen production, absorb wave energy and nutrients, and improve the clarity of the water. In addition, submerged aquatic vegetation beds stabilize bottom sediments and suspended sediments present in the water.

PWC use has the potential to impact submerged aquatic vegetation because the craft can access shallow water environments. Direct impacts resulting from collision or mechanical removal can occur. PWC use may also affect the growth and health or submerged aquatic vegetation as a result of increased turbidity, decreased available sunlight, and deposition of suspended sediments on plants. However, impacts of PWC and other motorized watercraft on submerged aquatic vegetation beds are not known.

WILDLIFE AND WILDLIFE HABITAT

Some research suggests that PWC impact wildlife through interruption of normal activities, alarm or flight; avoidance and displacement of habitat; and effects on reproductive success. This is thought to be caused by a combination of PWC speed, noise, and ability to access sensitive areas. At Cape Lookout, PWC can access sensitive areas such as marshes and tidal flats, potentially disrupting riparian habitat areas critical to wildlife.

Excessive noise may force nesting birds at Cape Lookout National Seashore, such as the piping plover, to abandon eggs during crucial embryo development stages and to flush other waterfowl from habitat in the marsh islands and at Portsmouth, Drum Inlets, and Power Squadron Spit causing stress and associated

behavior changes. Noise from PWC and other boats, as well as the physical presence of the craft, might affect the distribution of birds such as shorebirds, raptors, and waterfowl.

PWC may have a greater impact on marine mammals, specifically dolphins that frequent the waters of the park, because of the PWC noise and speed. Although the full impact that noise has on marine mammals is not completely understood, the increase in man-made underwater noises could be a serious problem to their survival as it can interfere with their methods of communication and hunting strategy.

THREATENED, ENDANGERED, AND SPECIAL CONCERN SPECIES

PWC users may affect federally listed sea turtles such as leatherbacks and marine mammals that access Back, Core, and Pamlico Sounds through the ocean inlets by colliding with them and harassing them, resulting in harm to the animal and in decreased distribution.

Piping plovers may be affected by PWC noise and presence in areas such as New Drum Inlet during nesting and chick fledging. Other special concern species located at Cape Lookout National Seashore include the northern right whale, humpback whale, Florida manatee, Kemp's Ridley, leatherback, green, and loggerhead sea turtles, American alligator, Carolina diamondback terrapin, Carolina water snake, Outer Banks kingsnake, roseate tern, American bald eagle, peregrine falcon, gull-billed tern, black skimmer, brown pelican, common tern, glossy ibis, least tern, little blue heron, loggerhead shrike, snowy egret, tricolored heron, and seabeach amaranth.

VISITOR USE AND EXPERIENCE

PWC are more likely than other watercraft to be operated for long periods of time within a confined area such as Shackleford Banks, degrading the experience of other visitors in the same area due to their noise and speed.

At Cape Lookout National Seashore, visitors have complained that PWC use conflicts with swimming, kayaking, and other beach activities. A goal of the national seashore is to provide visitors with opportunities for an isolated experience typical of a barrier island. PWC use near the shoreline of Shackleford Banks and Cape Lookout makes this difficult**.**

Park staff observed that PWC operated for longer periods of time in areas of heavy visitor use at Shackleford Banks and within the Lookout Bight. These areas support other visitor activities such as boating, fishing, and camping. Visitors also travel via ferry to Cape Lookout to see the lighthouse and historic district. The greater number of PWC that have historically occurred in these areas (prior to the closure) and the heavy visitor concentrations during summer months creates a greater potential for conflict and for disturbance from PWC noise. Prior to closing to PWC, park visitors complained about safety and noise issues. Canoeists and kayakers, in particular, complained most frequently.

VISITOR CONFLICT AND VISITOR SAFETY

The National Transportation Safety Board reported that in 1996 PWC represented 7.5% of state-registered recreational boats, but accounted for 36% of recreational boating accidents. In the same year PWC operators accounted for more than 41% of people injured in boating accidents. PWC operators accounted for approximately 85% of the persons injured in accidents studied in 1997 (NTSB 1998). In part, this is believed to be a "boater education" issue, i.e., inexperienced riders lose control of the craft; yet it also is a

function of the PWC operation, i.e., no brakes or clutch. When drivers let up on the throttle to avoid a collision, steering becomes difficult. Due to their maneuverability, ability to reach high speeds, and access shallow-draft areas, PWC can create wakes that pose a conflict and safety hazard to other users, such as canoeists and kayakers.

At Cape Lookout National Seashore, these issues were compounded by the fact that most PWC use was focused at the most heavily used areas in the parks – the western third of Shackleford Banks and Cape Lookout. During the year 2000, the occurrence of PWC was documented during routine patrols of Cape Lookout National Seashore. Approximately 380 observations over 210 days occurred on the islands of the national seashore, during which a total of 523 PWC were noted operating within the park. Twelve of these PWC were observed committing some type of legal violation.

Since 2000, the park has not kept or noted PWC accidents or violations. Accident data provided by the park indicates that, during random patrols in 2001, there were no PWC-related accidents reported to the NPS. In 2002, one PWC user had to be evacuated to a local hospital because of back injuries sustained while crossing rough or high waves. PWC accidents or rescues are not likely to be reported through the NPS because most PWC operate outside of the NPS jurisdiction (150 feet from mean low water). The U.S. Coast Guard has documented few rescues in the last few years. Most accidents are likely handled outside of normal, official reporting and are probably not easily extractable.

CULTURAL RESOURCES (NATIONAL HISTORIC PRESERVATION ACT, SECTION 106)

Cultural resources that are listed on, or potentially eligible for listing on, the National Register of Historic Places may be affected by erosion along shorelines, or uncontrolled visitor access since riders are able to access, beach, or launch in areas less accessible to most motorcraft. Cape Lookout has 36 recorded archeological sites within the national seashore. Infrequent monitoring is unlikely to prevent further deterioration from vandalism or looting activities. Monitoring is not effective in protecting sites from environmental elements changing the landscape of the barrier islands.

SOCIOECONOMIC EFFECTS

PWC sales were once the fastest growing segment of the boating industry in the country. PWC rentals have also increased exponentially compared to other types of watercraft. Tourism is an extremely important part of Cape Lookout's local economy. Businesses that cater specifically to PWC users, such as rental shops and sales/service shops, could be directly affected by PWC use regulations at the national seashore. Other businesses, such as hotels and restaurants, could be indirectly affected by these regulations. However, PWC users comprised approximately only 1% of all national seashore visitors before the ban went into effect.

CAPE LOOKOUT NATIONAL SEASHORE MANAGEMENT AND OPERATIONS

PWC, because of their increased accident rates and visitor conflicts, often require additional park staff to enforce standards, limits, or closures. Currently, Cape Lookout National Seashore does little or no water-based enforcement. PWC enforcement will divert resources from other high priority and under-staffed protection activities.

Some state and local governments have taken action, or are considering taking action, to limit, ban, and otherwise manage PWC use. While the national seashore may be exempt from these local actions,

consistency with state and local plans must be evaluated. North Carolina has adopted PWC regulations since 2000 that govern PWC users within all the state waters surrounding and within the Cape Lookout barrier islands. These regulations dictate age limits and operational procedures for safe use. Because NPS boating regulations contained in 36 CFR adopt North Carolina State boating regulations, including PWC rules, the NPS enforces PWC in cooperation with the state. However, many local jurisdictions along the Outer Banks have adopted supplemental or more stringent PWC regulations.

ISSUES ELIMINATED FROM FURTHER CONSIDERATION

As explained below, the following impact topics and issues have been dismissed from further consideration:

Cultural Landscapes – No new cultural resource investigations were carried out as part of this study. The landscape associated with Cape Lookout has yet to be evaluated as a cultural landscape. It is possible that other potentially eligible landscapes could be either outside the study area or in areas already experiencing heavy visitor use from both land and water vehicles. The impacts resulting from PWC users would be extremely difficult to distinguish or quantify.

Historic Structures – Currently, 74 structures are on the national seashore's List of Classified Structures, all of which relate to the structures already listed or determined eligible for listing on the national register. Given that the majority of historic structures within the park are either located outside the study area or in areas already experiencing heavy visitor use from land and water vehicles, the impacts (if any) resulting from the proportionately low number of PWC would be extremely difficult to distinguish or quantify.

Museum Collections – The museum management program, park profile for Cape Lookout indicates that the park has over 2,153 objects and specimens. The artifact collection is being stored in facilities at the national seashore. Given the collection's location, there are no impacts from PWC use in the national seashore to this cultural resource.

Ethnographic / Sacred Sites – There are no known ethnographic resources or sacred sites within the vicinity of previously used or potential future landing areas for PWC use areas. While ethnographic resources or sacred sites have not yet been formally evaluated for their status as traditional cultural properties / sacred sites, it is possible that potentially eligible resources could be either outside the study area or in areas already experiencing heavy visitor use from both land and water vehicles. The impacts resulting from PWC users would be extremely difficult to distinguish or quantify.

Paleontological Resources – While the coastal areas of North Carolina have seen continuous human occupation, little is known about the paleontological resources of the park. It is possible that potentially eligible resources could be either outside the study area or in areas already experiencing heavy visitor use from both land and water vehicles. The impacts resulting from PWC users would be extremely difficult to distinguish or quantify.

Environmental Justice – No environmental justice issues are known to exist around PWC use at Cape Lookout at this time. There are no known minority populations or federally registered tribes that would be impacted by the management or continued ban of PWC use within the national seashore. Impacts expected to the local economy under the action alternatives are expected to be minor (LAW 2004).

RELATIONSHIP TO OTHER PLANS, POLICIES, AND ACTIONS

The following plans, policies, and actions could affect the alternatives being considered in this environmental assessment. These plans and policies were also considered in the analyses of cumulative effects.

NATIONAL PARK SERVICE PLANS, POLICIES, AND ACTIONS

Other plans, policies, and actions at the federal, state, and local level that may affect decisions for PWC use were discussed with the NPS staff, along with existing and future plans and policies at Cape Lookout. A list of plans, policies, and other actions that may be relevant to PWC use or cumulative impacts analysis follows:

1980 General Management Plan (NPS 1980) – The 1980 GMP provides an outline of park-wide plan for addressing management objectives.

Cape Lookout National Seashore: Superintendent's Compendium (NPS 2003b) – Annual compendiums are composed by park superintendents to detail specific regulations applicable to a variety of topics within park units. The current *Superintendent's Compendium* outlines regulations relevant to public recreation use within the national seashore.

Strategic Plan [NPS 2000c] – The *Strategic Plan* addresses topics such as the mission of Cape Lookout National Seashore and goals for accomplishing and maintaining the mission. Strategies for achieving these goals are discussed, as well as long-term goals for the 5-year period covered in the plan. Mission goals of the park addressed in the *Strategic Plan* fall under the following categories:

- Preserve park resources.
- Provide for the enjoyment and visitor experience of the park.
- Ensure organizational effectiveness.

These goals have been incorporated into the development of objectives and alternatives presented in this environmental assessment.

Cape Lookout National Seashore Amendment to General Management Plan and Environmental Assessment 2001 (*GMP Amendment* [NPS 2001a]) – The amendment examined a range of alternative actions to improve overnight accommodation and transportation service for persons visiting the North Core Banks (excluding the Portsmouth area) and South Core Banks. The amendment focused on possible improvements to overnight accommodations and transportation services for persons visiting North Core Banks (excluding the Portsmouth Island area) and South Core Banks at Cape Lookout National Seashore. In summary, the Finding of No Significant Impact (FONSI) proposed that the NPS:

- Negotiate long-term contracts with concessionaires to transport visitors and vehicles from the towns of Davis, North Carolina and Atlantic, North Carolina to Great Island and Long Point, both sites on the Core Banks, Cape Lookout National Seashore, North Carolina;
- Improve overnight accommodations by removing old cabins at Great Island and constructing 30 new cabins;

- Add 10 new cabins at Long Point;
- Improve relationships by issuing biennial incidental business permits to small craft operators that provide transport services to visitors to Cape Lookout keeper's quarters area;
- Reduce the number of parking spaces near the keeper's quarters; and
- Develop an Off-Road Vehicle (ORV) Plan.

Air Resources Management *(NPS Management Policies 2001*, sec. 4.7 [NPS 2001d]) – The Air Resources Management section highlights NPS goals and objectives regarding air quality, weather, and climate. This plan proposes an aggressive role for the NPS in preserving, protecting, and enhancing the air quality in all park units. The NPS aims to preserve the natural quite and sounds associated with each park. To ensure protection from excessive noise, monitoring programs and necessary actions should be applied to prevent adverse effects to the natural resources and to the visitors at each park. While the plan addresses the need to protect the park's air quality and noise environment associated with all new and human sources, there are no specific regulations for personal or motorized watercraft.

FUTURE CAPE LOOKOUT NATIONAL SEASHORE PLANS AND ACTIONS

The following list of plans, policies, and other actions planned for the future may be relevant to PWC use or cumulative impacts analysis:

- *Development Concept Plan* at Cape Lookout (The plan will address needed restrooms and potential relocation of concession facilities/parking near the Cape Lookout Lighthouse.)
- *Commercial Services Plan* (Ongoing, 2004-2006. The *Commercial Services Plan* will address the need for and desirability of a variety of visitor services provided by commercial enterprises, including such items as ferry operations, cabin rental, land transportation services, rentals, concession food and supplies.)
- *General Management Plan Amendment* (1999) (Completed 1999. This plan addressed the need for transportation and concession lodging services.)
- *General Management Plan* (Scheduled for FY 2005-6. The GMP is a parkwide medium to long range plan addressing all aspects of park operation and management.)
- *Cape Lookout Historic District Management Plan* (Ongoing, 2004-2005. Planning and environmental assessment required as result of litigation, this plan addresses future reuse of structures within the Cape Village Historic District.)
- *Cultural Landscape Plans* (Ongoing, 2004-2005. There are two significant cultural landscapes within Cape Lookout National Seashore, Portsmouth Village Historic District and the Cape Village Historic District that have not been inventoried. The plans provide important information on the history and evolution of landscape features at these locations. The information is necessary to inform future management of these areas.)
- *Comprehensive Interpretive Plan* (This plan articulates the park's purpose, significance and themes and is necessary to inform/guide the park's interpretive and education programs.)

- Beach re-nourishment project near Cape Lookout Lighthouse (Environmental assessment to determine impacts of using beach re-nourishment for stabilizing the soundside shore adjacent to the Cape Lookout Lighthouse. Project is proposed for protection of the Cape Lookout Lighthouse and associated historic structures.)

- Shoreline stabilization at Harker's Island (Environmental assessment to determine impacts of alternatives for stabilizing eroding shoreline at the Harker's Island / Headquarters Area of the seashore. Developments at this site are threatened by ongoing shoreline loss.)

- *Exhibit Plan* at Harker's Island and Cape Lookout Keeper's Quarters (Exhibit planning and design for new exhibits. At the Harker's Island exhibits will orient visitors to the breadth of resources and recreational opportunities within the park. At the Keeper's Quarters exhibits will orient visitors to the cape area and interpret the history of the lighthouse complex and associated historic resources.)

- Transfer of Cape Lookout Lighthouse from U.S. Coast Guard to NPS (Completed in June, 2003.)

- General cooperative agreements: North Carolina Colonial Waterbird Committee; State Veterinarian regarding wild horses on Shackleford Banks

- Plans from North Carolina Division of Marine Resources

- *Horse Management Plan* (Current plan in force will be up for review in FY 2005. This plan defines how the culturally significant feral horse population on Shackleford Banks is cooperatively managed by both the National Park Service and the Foundation of Shackleford Horses.)

OTHER FEDERAL AGENCY PLANS, POLICIES, OR ACTIONS

1972 Coastal Zone Management Act – In recognition of the increasing pressures of over-development upon the nation's coastal resources, Congress enacted the *Coastal Zone Management Act* in 1972. The act encourages states to preserve, protect, develop, and where possible, restore or enhance valuable natural costal resources such as wetlands, floodplains, and estuaries. Beaches, dunes, barrier islands, and coral reefs, as well as the fish and wildlife using those habitats. A unique feature of the coastal zone management program is that participation by states is voluntary. To encourage states to participate, the act makes federal financial assistance available to any coastal state or territory that is willing to develop and implement a comprehensive coastal management program.

State coastal zones include the coastal waters and adjacent shorelands that extend inland to the extent necessary to control activities that have a direct significant impact on coastal waters. For federal approval, a coastal zone management plan must (1) identify the coastal zone boundaries; (2) define the permissible land and water uses within the coastal zone that have a direct and significant impact on the coastal zone and identify the state's legal authority to manage these uses; (3) inventory and designate areas of particular concern; (4) provide a planning process for energy facilities siting; (5) establish a planning process to assess the effects of, and decrease the impacts from, shoreline erosion; and (6) facilitate effective coordination and consultation between regional, state, and local agencies. The National Oceanic and Atmospheric Administration approve coastal zone management plans and oversee subsequent implementation of programs.

Cedar Island National Wildlife Refuge (a new refuge plan) – Cedar Island National Wildlife Refuge is located directly across Core Sound near the north end of the national seashore. The Refuge began developing a *Comprehensive Conservation Plan* in September 2000. The largest effort was initially invested in formulating a land protection strategy that was to link the refuge to other protected lands to the west (Forest Service, Department of Defense, state wildlife commission, nongovernment organizations, etc.) by fee simple acquisition and easements. The public had expressed an interest in seeing the refuge expand to protect water quality, provide more hunting areas, and save the area from development. Five alternative plans were developed, three without land acquisition and two with acquisition. An internal review draft is expected by October 1; the public review draft is expected a few months afterwards.

No substantial changes in the appearance of the refuge are expected under any alternative. The plan will address monitoring of vegetative communities and wildlife populations, the response of those communities and populations to management with prescribed fire, and the adaptation of the fire management plan in response to monitoring. A limited increase in public use may occur, primarily as a result of environmental education, interpretation, wildlife observation, and photography.

The refuge's ownership and law enforcement authority extends to the mean high tide level (as defined by the vegetation line). The state enforces regulations on the water. The North Carolina refuges in the U.S. Fish and Wildlife Service are developing a strategy to approach the state about co-managing the waters (streams, bays, inlets) that encroach into the refuges in northeastern North Carolina. The Service's interest is focused on enforcing hunting and fishing regulations on those waters (Robert Glennon, Natural Resource Planner, U.S. Fish and Wildlife Service pers. comm. 8/31/04).

STATE, LOCAL GOVERNMENT PLANS, POLICIES, OR ACTIONS

Many local North Carolina jurisdictions have adopted supplemental or more stringent PWC regulations. North Carolina political jurisdictions that have enacted legislation curtailing PWC operations, principally by means of distance requirements or minimum age limitations, include Atlantic Beach (which is located west of Shackleford Banks), Brunswick County, Carolina Beach, Emerald Isle, Holden Beach, Kitty Hawk, New Hanover County, Ocean Isle, Southern Shores, Sunset Beach, Topsail Beach (Bradley 1999). None of these towns and counties exists within the national seashore jurisdiction. PWC use is prohibited at nearby Cape Hatteras National Seashore, which lies immediately north of Cape Lookout. PWC use is also prohibited at Fort Macon State Park, which is immediately west of Shackleford Banks across Beaufort Inlet.

ALTERNATIVES

All alternatives must be consistent with the purpose and significance of Cape Lookout National Seashore and meet the purpose of and need for action, as well as the objectives for the project. Three alternatives are described in this section; no other alternatives were considered. A summary of alternatives is included in table 3 and the impacts expected under each alternative are included in table 4. Both tables are included at the end of this chapter, along with table 5, which summarizes how the alternatives meet objectives.

The alternatives analyzed in this document in accordance with the *National Environmental Policy Act* are the result of agency and public scoping input, and as stipulated in the settlement agreement between Bluewater Network and the NPS. The action alternatives address continued PWC use under a special regulation that allows for previous PWC access and use patterns or for new management strategies and mitigation measures that restrict PWC access. The no-action alternative represents the current PWC use ban at Cape Lookout National Seashore that has been in place since April of 2002.

COMMON TO ALL ALTERNATIVES

The state of North Carolina ceded to the NPS legal jurisdiction of all land and waters from the mean low water on the oceanside to 150 feet from the mean low water mark on the soundside. Waters beyond this 150 feet boundary within Back Sound and beyond the legislated boundary along Core Sound are managed by the state of North Carolina. Legal jurisdiction on the oceanside of Shackleford Banks, South Core Banks, and North Core Banks is the mean low water mark.

NO-ACTION ALTERNATIVE: CONTINUE PROHIBITION OF PWC USE IN CAPE LOOKOUT NATIONAL SEASHORE

Under the no-action alternative, PWC use at Cape Lookout National Seashore would continue to be prohibited. The PWC ban that was authorized at Cape Lookout National Seashore on April 22, 2002 as a result of the settlement agreement with Bluewater Network would remain in place, because the NPS would not take action to draft a special regulation to continue PWC use.

The *Cape Lookout National Seashore: Superintendent's Compendium* (sec. 1.5(a)(j) [NPS 2003b]) currently reflects the ban that resulted from the settlement agreement, and therefore states that PWC launching or landing on any lands, boat ramps, or docks within the boundaries of Cape Lookout National Seashore would be prohibited. PWC would not be towed on trailers or carried on vehicles within the boundaries of the national seashore (except at the Harker's Island unit). PWC operation on waters within the boundaries of the national seashore would be prohibited. This would include all waters within 150 feet from the mean low water mark on the soundside of the park. No beaching would be allowed on the oceanside of the barrier islands. This prohibition would not apply to PWC operated by duly authorized federal, state, or local law enforcement and emergency response agencies whose jurisdictions lie within or adjoin Cape Lookout National Seashore and when engaged in training, enforcement, or rescue activities.

ALTERNATIVE A: REINSTATE PWC USE UNDER A SPECIAL NPS REGULATION AS PREVIOUSLY MANAGED

Under alternative A, a special NPS regulation would be written to reinstate PWC use within Cape Lookout National Seashore in accordance with *NPS Management Policies 2001* [NPS 2001d] and North Carolina state PWC regulations with no additional PWC restrictions.

Areas of Use. All areas under legal jurisdiction of Cape Lookout would be open to PWC use and access. This would include all waters within 150 feet from the mean low water mark on the soundside of the park. In addition, PWC would be allowed to beach on the oceanside.

State PWC Regulations. The following North Carolina PWC regulations would be enforced within Back and Core Sounds (including waters within Cape Lookout National Seashore).

- No one under 12 years old can operate a PWC in North Carolina waters. A person at least 12 years old, but less than 16 years old, can operate a PWC if they are riding with a person who is at least 18 or the youth has first successfully completed an approved boating safety education course (must carry proof of age and course completion while operating PWC).

- No one can operate a PWC on state waters between sunset and sunrise. All PWC riders, passengers, and those being towed must wear approved personal flotation devices.

- If the PWC is equipped with a lanyard-type engine cut off switch, the lanyard must be worn by the operator at all times.

- A PWC must have a rearview mirror or an observer on board besides the operator to legally tow someone on skis or similar device.

- PWC must be operated at all times in a reasonable and prudent manner. Maneuvers that endanger people or property constitute reckless operation.

- No person shall operate a PWC on the waters of this State at greater than no-wake speed within 100 feet of an anchored or moored vessel, a dock, pier, swim float, marked swimming area, swimmers, surfers, persons engaged in angling, or any manually operated propelled vessel, unless the PWC is operating in a narrow channel [2].

- No person shall operate a PWC in a narrow channel at greater than no-wake speed within 50 feet of an anchored or moored vessel, a dock, pier, swim float, marked swimming area, swimmers, surfers, persons engaged in angling, or any manually operated propelled vessel.

- No person shall operate a PWC towing another person on water skis or similar device unless the total number of persons operating, observing, and being towed does not exceed the number of passengers identified by the manufacturer as the maximum safe load for the vessel.

- Reckless PWC operation includes the following:

  – Unreasonable or unnecessary weaving through congested boat traffic.

2. Narrow channel - A “narrow channel” means a segment of the waters of the State 300 feet or less in width.

- Jumping the wake of a vessel within 100 feet of the vessel or when visibility is obstructed.
- Intentionally approaching a vessel in order to swerve at the last moment.
- Operating contrary to the "rules of the road."
- Following too closely[3] to another vessel, including another PWC.

ALTERNATIVE B: REINSTATE PWC USE UNDER A SPECIAL NPS REGULATION WITH ADDITIONAL MANAGEMENT PRESCRIPTIONS (PREFERRED ALTERNATIVE)

Under this alternative, special use areas would be identified where PWC could access certain sections of Shackleford Banks, South Core Banks, and North Core Banks. PWC use and access would be prohibited in all other areas of the national seashore, and PWC would not be allowed to beach on the oceanside. Safety and operating restrictions would be dictated by the North Carolina PWC regulations outlined under alternative A and additional NPS operating restrictions.

Special Use Areas. Ten special use areas would provide for PWC access within Cape Lookout National Seashore boundaries. PWC would be allowed to access these areas on North Core Banks, South Core Banks (including Cape Lookout), and Shackleford Banks by remaining perpendicular to shore and operating at flat-wake speed. Under this alternative, PWC use would not be authorized for recreational use parallel to the shoreline, but only for access to those areas identified below specifically for landing purposes. In all cases, PWC would have access to the sound side of the barrier islands only. No PWC access to the seashore's ocean side would be permitted.

North Core Banks.

- *Ocracoke Inlet Access* – Wallace Channel dock to the demarcation line in Ocracoke Inlet
- *Long Point Access* – Ferry landing at Morris Kabin Kamp and Long Point Cabin area
- *Milepost 11B Access* – Existing dock at mile post 11B approximately 4 miles north of Long Point
- *Old Drum Inlet Access* – Soundside beach (as designated by signs), approximately 1/2 mile north of Old Drum inlet (adjacent to the cross-over route) encompassing approximately 50 feet

South Core Banks.

- Great Island Access: Carly Dock at Alger Willis Fish Camps (noted as South Core Banks-Great Island on map)

3. Following too closely - The term "following too closely" means proceeding in the same direction and operating at a speed in excess of 10 miles per hour when approaching within 100 feet to the rear or 50 feet to the side of another vessel that is underway unless that vessel is operating in a narrow channel, in which case a personal watercraft may operate at the speed and flow of other vessel traffic.

- *New Drum Inlet Access* – Soundside beach (as designated by signs), approximately 1/4 mile long, beginning approximately 1/2 mile south of New Drum Inlet

Cape Lookout.

- *Lighthouse Area South Access* – Soundside beach 100 feet south of the "summer kitchen" to 200 feet north of the Cape Lookout Environmental Education Center Dock

- *Lighthouse Area North Access* – A zone 300 feet north of the NPS dock at the lighthouse ferry dock

- *Power Squadron Spit Access* – Soundside beach at Power Squadron Spit across from rock jetty to end of the spit

Shackleford Banks.

- *Shackleford West End Access* – Soundside beach at Shackleford Banks from Whale Creek west to Beaufort Inlet, except the area between the Wade Shores toilet facility and the passenger ferry dock

Access and Wake Restrictions. Within these special use areas, all PWC would be required to remain perpendicular to shore and operate at flat-wake speed that would result in no visible wake within park waters.

Equipment and Emissions. As noted in the "Introduction," the Environmental Protection Agency promulgated a rule to control exhaust emissions from new marine engines, including outboards and PWC. Emission controls provide for increasingly stricter standards beginning in model year 1999 (EPA 1996a, 1997). Under this alternative, it is assumed that PWC two-stoke engines would be converted to cleaner direct-injected or four-stroke engines in accordance with the Environmental Protection Agency's assumptions (40 CFR Parts 89-91, "Air Pollution Control; Gasoline Spark-Ignition and Spark-Ignition Engines, Exemptions; Rule, 1996). Cape Lookout would not accelerate this conversion from two-stroke to four-stroke engines for PWC.

Visitor Education. Cape Lookout park staff would support the state boater education program by annually outlining state and park PWC regulations within park brochures such as the park newspaper. Park staff would educate visitors about PWC regulations in park and state waters to help them understand the differences between park regulations and PWC regulations for other local jurisdictions along the Outer Banks.

Cooperation with Local Entities. The park would work with local and state governments to encourage consistent PWC user behavior within state waters adjacent to park PWC special use areas. The park would like to encourage the state to define a PWC use zone in state waters adjacent to Cape Lookout National Seashore that would encourage flat-wake and perpendicular access to the shore.

ALTERNATIVES CONSIDERED BUT NOT ANALYZED FURTHER

The following PWC management strategies were considered, but were not included in the alternatives.

- *Expansion of PWC use* – This option is not consistent with NPS policy and directives to actively manage PWC use.

- *Limit use by season or time of day* – No reason exists to limit use in one season or another except to minimize conflicts with other users in congested areas. This option does not address the public's desire to use PWC to access beaches in conjunction with other primary summer activities.

- *Establish launch conditions or restrictions* – Cape Lookout has no launch ramps within the park.

- *Authorize only concessionaires to provide PWC to rent* – Concessionaires do not provide this service and it is not part of their concession contract.

- *Allow PWC use under permit only to limit numbers* – This option would be difficult to implement due to unlimited entry points into the park, current administrative workload, and lack of enforcement staff.

- *Provide additional PWC access points (under alternative B) at New and Old Drum Inlet, Codds Creek Dock, and along North and South Core Banks* – PWC use would conflict with piping plover habitat at New and Old Drum Inlet and with kayaking use at Codds Creek. Other access points are not available along the North and South Core Banks because of the extensive marshes that prevent PWC and boating access.

THE ENVIRONMENTALLY PREFERRED ALTERNATIVE

The environmentally preferred alternative is defined by the Council on Environmental Quality as the alternative that best meets the following criteria or objectives, as set out in *NEPA* (sec. 101):

- Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations.

- Ensure for all Americans a safe, healthful, productive, and aesthetically and culturally pleasing surroundings.

- Attain the widest range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences.

- Preserve important historic, cultural, and natural aspects of our national heritage and maintain, whenever possible, an environment that supports diversity and variety of individual choice.

- Achieve a balance between population and resource use that will permit high standards of living and a wide sharing of life’s amenities.

- Enhance the quality of renewable resources and approach the maximum attainable recycling of depleteable resources.

This discussion also summarizes the extent to which each alternative meets *NEPA* (sec. 102(1)), which asks that agencies administer their own plans, regulations, and laws so that they are consistent with the policies outlined above to the fullest extent possible.

The no-action alternative would ensure a safe, healthful, productive, and aesthetically and culturally pleasing area for visitors to access without the threat of PWC users introducing noise and safety concerns. The no-action alternative would attain the widest range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences by continuing the prohibition of PWC use within all waters of the national seashore. However, the no-action alternative would not maintain an environment that supports diversity and variety of individual choice, nor would it achieve a balance between population and resource use that permits a wide sharing of amenities.

Alternative A would satisfy the majority of the six requirements detailed above; however, alternative A would not ensure for safe, healthful, productive, and aesthetically pleasing surroundings by allowing PWC use in areas frequented by non-PWC recreationists. Of the alternatives analyzed, alternative A would not attain the widest range of beneficial uses of the environment while minimizing degradation, risk of health or safety, or other undesirable and unintended consequences because of the potential impacts of PWC use to visitor experiences, natural resources, and other opportunities in the national seashore. For this reason, alternative A is not preferred from an environmental perspective.

Under alternative B, 51 miles of the soundside of the seashore (which is where the majority of boat use occurs) would be closed to PWC use, as well as 56 miles of the seashore's oceanside. Five of a total of 10 miles (50%) of the sandy beaches located on the soundside would be available to PWC use. PWC access would be distributed along the entire seashore at 10 locations. Alternative B would have limited impacts on the national seashore's natural resources through protection of shoreline areas with special use areas and flat-wake zoning prescriptions. In addition, the implementation of the flat-wake zoning under alternative B would meet park goals with respect to the protection of visitor experience and safety by implementing these restrictions in areas of high visitor activity. In the long-term, this alternative would support visitor enjoyment by allowing access to national seashore amenities by PWC users while accommodating other recreationists and meeting resource management objectives. This alternative would accommodate recreational opportunities for visitors while protecting sensitive natural resources within the national seashore. Alternative B is designed to meet the NPS general prohibition on PWC use for the protection of park resources and values, while providing recreational opportunities for PWC users.

Based on the analysis prepared for PWC use at Cape Lookout National Seashore, alternative B is considered the environmentally preferred alternative by best fulfilling park responsibilities as trustee of sensitive habitat; by ensuring safe, healthful, productive, and aesthetically and culturally pleasing surroundings; and by attaining a wider range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences.

Map 1: Location of Cape Lookout National Seashore

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Map 2: No-Action Alternative: Continue the Prohibition on PWC Use in Cape Lookout National Seashore

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Back of Map 2

Map 3: Alternative A: Reinstate PWC Use under a Special NPS Regulation as Previously Managed

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Map 4: Alternative B: Reinstate PWC Use under a Special NPD Regulation with Additional Management Prescriptions

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Back of Map 4

TABLE 3: SUMMARY OF ALTERNATIVES

PWC Management Action	No-Action Alternative: Continue Prohibition of PWC Use in Cape Lookout National Seashore	Alternative A: Reinstate PWC Use under a Special NPS Regulation as Previously Managed	Alternative B: Reinstate PWC Use under a Special NPS Regulation with Additional Management Prescriptions (Preferred Alternative)
Wake Restrictions	Not applicable.	Restrictions as described by the state of North Carolina as follows: • No person shall operate a PWC at greater than no-wake speed within 100 feet (50 feet in a narrow channel) of an anchored or moored vessel, a dock, pier, swim float, marked swimming area, swimmers, surfers, persons engaged in angling, or any manually operated propelled vessel (a narrow channel is a segment of water 300 feet or less in width).	In addition to the speed restricted areas outlined under alternative A, the following would also apply throughout the park: Within special use areas, all PWC would be required to remain perpendicular to shore and operate at an flat-wake speed that would result in no visible wake within park waters.
Use Area	PWC would not be allowed within park waters.	• All areas under legal jurisdiction of Cape Lookout would be open to PWC use and access. This would include all waters within 150 feet from the mean low water mark on the soundside of the park. In addition, PWC would be allowed to beach on the oceanside.	Ten special use areas would provide for PWC access within Cape Lookout boundaries. **North Core Banks:** 1. Ocracoke Inlet Access: Wallace Channel dock to the demarcation line in Ocracoke Inlet 2. Long Point Access: Ferry landing at Morris Kabin Kamp and Long Point Cabin area 3. Milepost 11B Crossover Access: Existing dock at mile post 11B approximately 4 miles north of Long Point 4. Old Drum Inlet Access: Soundside beach (as designated by signs), approximately 0.5 mile north of Old Drum Inlet (adjacent to the cross-over route) encompassing approximately 50 feet **South Core Banks:** 5. Great Island Access: Carly Dock at Alger Willis Fish Camps 6. New Drum Inlet Access: Soundside beach (as designated by signs), approximately 0.25 mile long, beginning approximately 0.5 mile south of New Drum Inlet

PWC Management Action	No-Action Alternative: Continue Prohibition of PWC Use in Cape Lookout National Seashore	Alternative A: Reinstate PWC Use under a Special NPS Regulation as Previously Managed	Alternative B: Reinstate PWC Use under a Special NPS Regulation with Additional Management Prescriptions (Preferred Alternative)
			Cape Lookout: 7. Cape Lookout Lighthouse South Access: Soundside beach 100 feet south of the "summer kitchen" to 200 feet north of the Cape Lookout Environmental Education Center Dock 8. Cape Lookout Lighthouse North Access: A zone 300 feet north of the NPS dock at the lighthouse ferry dock 9. Power Squadron Spit Access: Soundside beach at Power Squadron Spit across from rock jetty to end of the Spit **Shackleford Banks:** 10. Shackleford Banks West Access: Soundside beach at Shackleford Banks from Whale Creek west to the Wade Shores toilet facility and from Beaufort Inlet east to the passenger ferry dock
	0% of the seashore would be open to PWC use.	100% of the seashore would be open to PWC use.	51 miles of the soundside and 56 miles of the oceanside of the seashore would be closed to PWC use; 50% of soundside sandy beaches would be available for PWC access.
PWC Numbers	None.	No limits.	No limits.
Equipment and Emissions	Not applicable.	PWC two-stroke engines would be converted to cleaner direct-injection or four-stroke engines in accordance with the EPA rule regulating industry emission standards.	Same as alternative A.
Safety/Operating Restrictions			
Location / Age Limitations	Not applicable.	No one under 12 years old can operate a PWC in North Carolina waters. A person at least 12 years old, but less than 16 years old, can operate a PWC if they are riding with a person who is at least 18 or the youth has first successfully completed an approved boating safety education course (must carry proof of age and course completion while operating PWC).	Same as alternative A.
Time Restriction	Not applicable.	No one can operate a PWC on state waters between sunset and sunrise. All PWC riders, passengers and those being towed must wear approved personal flotation devices.	Same as alternative A.

PWC Management Action	No-Action Alternative: Continue Prohibition of PWC Use in Cape Lookout National Seashore	Alternative A: Reinstate PWC Use under a Special NPS Regulation as Previously Managed	Alternative B: Reinstate PWC Use under a Special NPS Regulation with Additional Management Prescriptions (Preferred Alternative)
Personal Flotation	Not applicable.	All recreational vessels must have one Type I, II or III personal flotation device of a suitable size for each person aboard and each skier being towed. In addition, recreational vessels 16 feet and over must also have one throwable Type IV personal flotation device.	Same as alternative A.
Reckless Behavior	Not applicable.	PWC must be operated at all times in a reasonable and prudent manner. Maneuvers that endanger people or property constitute reckless operation. Reckless PWC operation includes the following: • Unreasonable or unnecessary weaving through congested boat traffic. Jumping the wake of a vessel within 100 feet of the vessel or when visibility is obstructed. • Intentionally approaching a vessel in order to swerve at the last moment. Operating contrary to the “rules of the road." • Following too closely to another vessel, including another PWC. The term "following too closely" means proceeding in the same direction and operating at a speed in excess of 10 miles per hour when approaching within 100 feet to the rear or 50 feet to the side of another vessel that is underway unless that vessel is operating in a narrow channel, in which case a PWC may operate at the speed and flow of other vessel traffic.	Same as alternative A.
Lanyard / Cut-off	Not applicable.	If the PWC is equipped with a lanyard-type engine cut off switch, the lanyard must be worn by the operator at all times.	Same as alternative A.
Education	Information regarding the closure will be available to the public.	Operators under the age of 16 are required to complete an approved boating safety education course.	Cape Lookout park staff would support the state boater education program by annually outlining state and park PWC regulations within park brochures such as the park newspaper. Park staff would educate visitors about PWC regulations in park and state waters to help them understand the differences between park regulations and PWC regulations for other local jurisdictions along the Outer Banks.

TABLE 4: SUMMARY OF ENVIRONMENTAL CONSEQUENCES

Impact Topic	No-Action Alternative: Continue Prohibition of PWC Use in Cape Lookout National Seashore	Alternative A: Reinstate PWC Use under a Special NPS Regulation as Previously Managed	Alternative B: Reinstate PWC Use under a Special NPS Regulation with Additional Management Prescriptions (Preferred Alternative)
Water Quality	Continuing the prohibition on PWC use at Cape Lookout National Seashore would result in no impacts on water quality of park waters. On a cumulative basis, other motorized vessels would continue to have negligible adverse impacts on Cape Lookout's water quality due to their discharge of organic pollutants. Implementation of this alternative would not result in an impairment of water quality.	Under alternative A, water quality impacts from PWC use based on ecotoxicological and human health benchmarks would be negligible for all pollutants in all areas in both 2003 and 2013. Cumulative water quality impacts from all motorized watercraft under alternative A based on ecotoxicological benchmarks would be negligible for all pollutants in all areas in 2003 and 2013. Cumulative impacts on human health from all motorized watercraft would be negligible in 2003 and 2013. In 2013, cumulative water quality impacts from watercraft are expected to be lower than in 2003 due to reduced emission rates. Implementation of this alternative would not result in an impairment of water quality.	Under alternative B, water quality impacts from PWC use based on ecotoxicological and human health benchmarks would be negligible for all pollutants in all areas in both 2003 and 2013. Cumulative water quality impacts from all motorized watercraft under alternative B based on ecotoxicological benchmarks would be negligible for all pollutants in all areas in both 2003 and 2013. Cumulative impacts on human health from all motorized watercraft would be negligible in 2003 and 2013. In 2013, cumulative water quality impacts from watercraft are expected to be lower than in 2003 due to reduced emission rates. Implementation of this alternative would not result in an impairment of water quality.
Air Quality			
Impact to Human Health from Airborne Pollutants Related to PWC Use	Continuing the ban on PWC at Cape Lookout National Seashore would have no impacts on human health for PWC related CO, PM10, HC, and NOx emissions for both 2003 and 2013. Cumulative adverse impacts on human health from airborne pollutants in both 2003 and 2013 would be negligible for CO, HC, PM10 and NOx. Slightly increased NOx emissions in 2013 would result from increased boating activity and consideration of the conversion to new technology engines. However, with improved emission controls, future emissions of CO and HC would continue to decline. The reductions in HC emissions from conversion to cleaner engines would contribute to a reduced impact to regional ozone levels in 2013. Contributions from land-based sources of air emissions would likely be negligible. The risk from PAH also would be negligible in 2003 and 2013. Implementation of this alternative would not result in an impairment of air quality.	Alternative A would result in negligible adverse impacts on human health related to the PWC airborne pollutants CO, PM10, HC, and NOx for the year 2003. The risk from PAH would also be negligible. In 2013 there would be increases in CO, PM10, HC, and NOx emissions, and the impact level for these pollutants would remain negligible, the same as in 2003. The total increase in emissions resulting from alternative A for all pollutants is shown in table 28. Cumulative emission levels from all boating would be negligible for CO, PM10, NOx, and HC in 2003 and 2013. Overall, alternative A would have negligible adverse impacts on existing air quality conditions, with future reductions in PM10 and HC emissions due to improved emission controls. Overall, PWC emissions of HC are estimated to be less than 1% of the cumulative boating emissions in 2003 and 2013. Contributions from land-based sources of air emissions would likely be negligible. Implementation of this alternative would not result in an impairment of air quality.	Because no reduction in PWC use is expected, alternative B would result in negligible air quality impacts on human health from PWC emissions, similar to alternative A. The additional management prescriptions would slightly reduce PWC emissions as compared with alternative A. Negligible adverse impacts from PWC emissions for CO, PM10, HC, and NOx would occur in 2003 and 2013. The risk from PAH would also be negligible in 2003 and 2013. Cumulative adverse impacts from PWC and other boating emissions at the national seashore would be the same as for alternative A. Adverse impacts on human health from air pollutants in 2003 would be negligible for CO, PM10, NOx, and HC. In 2013, levels would remain negligible for CO, PM10, NOx, and HC. Regional ozone emissions would improve due to a reduction in HC emissions. This alternative would have negligible adverse impacts on human health air quality conditions, with future reductions in CO and HC emissions due to improved emission controls. The PWC contribution to emissions of HC is estimated to be less than 5% of the cumulative boating emissions in 2003 and 2013. All impacts would be long-term.

Impact Topic	No-Action Alternative: Continue Prohibition of PWC Use in Cape Lookout National Seashore	Alternative A: Reinstate PWC Use under a Special NPS Regulation as Previously Managed	Alternative B: Reinstate PWC Use under a Special NPS Regulation with Additional Management Prescriptions (Preferred Alternative)
			Implementation of this alternative would not result in an impairment of air quality.
Air Quality Related Values from PWC Pollutants	Under the no-action alternative, PWC would not contribute emissions at the national seashore and there would be no impacts on air quality related values from PWC in both 2003 and 2013. Cumulatively, there would be negligible long-term adverse impacts on air quality related values from all watercraft in 2003 and 2013. These conclusions are based on regional SUM06 values, the lack of existing or anticipated local ozone or visibility effects, and the calculated pollutant emission levels. Implementation of this alternative would not result in an impairment of air quality related values.	Negligible adverse impacts on air quality related values from PWC use would occur in both 2003 and 2013. Emissions of each pollutant would be substantially less than 50 tons per year in both 2003 and 2013. Compared to the no-action alternative, projected emission increases are shown in table 31. Negligible adverse impacts from cumulative emissions from motorized boats and PWC would occur in both 2003 and 2013. These conclusions are based on pollutant emissions, no observed visibility impacts or ozone-related plant injury in the national seashore, and regional SUM06 values, with very little influence from existing or forecast national seashore watercraft operations. Implementation of this alternative would not result in an impairment of air quality related values.	The impacts of alternative B on air quality related values would be the same as alternative A. Emissions of each pollutant would be substantially less than 50 tons per year in both 2003 and 2013. Compared to the no-action alternative, projected emission increases due to PWC use (as shown in table 30). Negligible adverse impacts on air quality related values from PWC would occur in both 2003 and 2013. In both 2003 and 2013, adverse impacts from cumulative emissions from motorized boats and PWC would be negligible. This conclusion is based on calculated levels of pollutant emissions (table 31), regional SUM06 values, and the lack of observed visibility impacts or ozone-related plant injury in the national seashore. Implementation of this alternative would not result in an impairment of air quality related values.
Soundscapes	Continuation of the PWC ban would result in no change to soundscapes at the national seashore, and there would be no contribution to noise impacts from PWC within national seashore boundaries. Cumulative noise impacts from motorboats, off-road vehicles, and other visitor activities would be short-term, negligible to minor, and adverse, concentrated particularly on the western end of Shackleford Banks and the Cape Lookout area on the south end of South Core Banks. Implementation of this alternative would not result in an impairment of the national seashore's soundscape.	Impacts from reinstating PWC use throughout the national seashore would be adverse, short-term, and negligible to moderate. Impacts would be negligible where use is infrequent and where visitation is low, and moderate in more congested areas. Although reinstating PWC use would add an additional noise source to the national seashore's soundscapes, cumulative impacts would remain adverse, short-term, and negligible to moderate given the historically low numbers of PWC use and the high numbers of motorized boats. Implementation of this alternative would not result in an impairment of the national seashore's soundscape.	PWC would be permitted in areas historically preferred by PWC users under this alternative, but only at flat-wake speed, resulting in adverse, short-term, negligible to minor impacts, depending on location. Cumulative impacts would be adverse, short-term, and negligible to minor under this alternative, depending on location. Implementation of this alternative would not result in an impairment of the national seashore's soundscape.

Impact Topic	No-Action Alternative: Continue Prohibition of PWC Use in Cape Lookout National Seashore	Alternative A: Reinstate PWC Use under a Special NPS Regulation as Previously Managed	Alternative B: Reinstate PWC Use under a Special NPS Regulation with Additional Management Prescriptions (Preferred Alternative)
Shoreline and Submerged Aquatic Vegetation	Continuing the prohibition on PWC use would result in no impacts on shoreline vegetation and submerged aquatic vegetation beds in park waters. Impacts associated with the operation of other vessels are expected to be adverse, direct and indirect, negligible to minor, and short- and long-term because most submerged aquatic vegetation beds could still be accessed, resulting in potential damage and loss of this habitat, as well as sediment resuspension and its effects. In addition, foot traffic would continue from other watercraft, causing negligible to minor indirect impact on shoreline vegetation. Implementation of this alternative would not result in an impairment of shoreline vegetation and submerged aquatic vegetation beds.	Impacts on shoreline vegetation from foot traffic associated with PWC access to beach areas, and to marsh habitats from PWC use in shallow water habits, would be short-term, indirect, and minor because of low levels of PWC use in affected areas and limited access to marshes and other shallow water habitats. Reinstating PWC use at Cape Lookout National Seashore would have impacts on submerged aquatic vegetation beds that are direct and indirect, negligible to minor, and short- and long-term. Cumulative impacts on shoreline vegetation and submerged aquatic vegetation habitats by all motorized vessels would be minor. Implementation of this alternative would not result in an impairment of shoreline vegetation and submerged aquatic vegetation beds.	Reinstating PWC use in park waters and restricting their operation to a flat-wake perpendicular approach to the shoreline in designated access areas is expected to have negligible, indirect short-term impacts on submerged aquatic vegetation beds and negligible to minor short-term impacts on shoreline vegetation. Non-PWC would still be able to access submerged aquatic vegetation beds under this alternative, and would be responsible for nearly all of the cumulative motorized vessel impacts on submerged aquatic vegetation beds. Motorized vessels, including PWC, are expected to have minor, direct and indirect, short- and long-term cumulative impacts on shoreline vegetation and submerged aquatic vegetation beds. Implementation of this alternative would not result in an impairment of shoreline vegetation and submerged aquatic vegetation beds.
Wildlife and Wildlife Habitats	Under the no-action alternative, there would be no impacts on wildlife from PWC use within the national seashore boundary. On a cumulative basis, negligible to minor, short-term adverse indirect impacts on wildlife would still occur as a result of PWC use adjacent to the national seashore boundary and other motorized uses. Implementation of this alternative would not result in an impairment of terrestrial or aquatic wildlife or habitats in park waters.	Reinstating PWC use in park waters is expected to have short-term, minor, direct and indirect adverse impacts on terrestrial and aquatic wildlife species and habitats. PWC use in the vicinity of Shackleford Banks and South Core Banks at the lighthouse, where both PWC use and general visitor use is highest, would have minor, short-term, adverse effects on terrestrial wildlife, such as shorebirds, using the landing area and adjacent areas and other species such as fish that using nearshore habitats to forage for food. Effects would be minor because species sensitive to a high level of noise and human activity are not expected to regularly use the landing area or immediately adjacent habitats during periods of high human use. The intensity of PWC use near the North and South Core Banks from Portsmouth Village to the lighthouse would be much less than near Shackleford Banks and the lighthouse Cumulative impacts associated with an increase in all types of motorized watercraft use are expected to be short-term, minor, direct and indirect, and adverse.	Alternative B would minimize potential adverse impacts of PWC use in the 10 designated special use areas to negligible to minor, short-term, adverse impacts. The no-wake requirements would reduce the level of PWC disturbance in the restricted areas and in nearby marshes. Reinstating PWC use in park waters and restricting their operation to a flat-wake perpendicular approach to the shoreline in designated access areas is expected to have short-term, negligible to minor, direct and indirect adverse impacts on terrestrial and aquatic wildlife species and habitats. Cumulative impacts associated with an increase in all types of motorized vessel use are expected to be short-term, negligible to minor, direct and indirect, and adverse. Implementation of this alternative would not result in an impairment of terrestrial or aquatic wildlife or habitats in park waters.

Impact Topic	No-Action Alternative: Continue Prohibition of PWC Use in Cape Lookout National Seashore	Alternative A: Reinstate PWC Use under a Special NPS Regulation as Previously Managed	Alternative B: Reinstate PWC Use under a Special NPS Regulation with Additional Management Prescriptions (Preferred Alternative)
		Implementation of this alternative would not result in an impairment of terrestrial or aquatic wildlife or habitats in park waters.	
Aquatic Fauna	Continuing the prohibition on PWC use within park waters would eliminate adverse impacts from PWC within park boundaries. Impacts on aquatic fauna in park waters from non-PWC motorized vessels noise under the no-action alternative would be expected to be adverse, minor, and short-term. Implementation of this alternative would not result in an impairment of aquatic fauna.	Reinstating PWC use in park waters would be expected to have short-term, minor, adverse impacts on aquatic fauna due to noise. Implementation of this alternative would not result in an impairment of aquatic fauna.	Reinstating PWC use in park waters and restricting their operation to a flat-wake perpendicular approach to the shoreline in designated access areas is expected to have short-term, negligible, adverse impacts on aquatic fauna. Implementation of this alternative would not result in an impairment of aquatic fauna.
Threatened, Endangered, or Other Special Concern Species	Continuing the prohibition on PWC use within Cape Lookout National Seashore would ensure that special concern species are not affected by PWC use within park waters. Other motorized watercraft may affect but are not likely to adversely affect these species in park waters because of the slow travel speeds and short trip lengths and location of use. Implementation of this alternative would not result in an impairment of terrestrial or aquatic threatened, endangered, or special concern species in park waters.	Reinstating PWC use within Cape Lookout National Seashore may affect but is not likely to adversely affect manatees or whales in park waters, as these species are not present in areas or during seasons of peak PWC use. PWC and other motorized vessel use may affect but is not likely to adversely affect sea turtles, Carolina diamondback terrapins, or special concern birds because of the slow vessel speeds and short trip lengths. Implementation of this alternative would not result in an impairment of terrestrial or aquatic threatened, endangered, or special concern species in park waters.	Reinstating PWC use in park waters and restricting their operation to a flat-wake perpendicular approach to the shoreline in designated access areas may affect but is not likely to adversely affect manatees or whales in park waters, as these species are not present in areas or during seasons of peak PWC use. PWC and other motorized vessel use may affect but is not likely to adversely affect sea turtles or Carolina diamondback terrapins because of the slow vessel speeds and short trip lengths. Implementation of this alternative would not result in an impairment of aquatic special concern species in park waters.
Visitor Use and Experience	Implementation of the PWC ban would have no impacts on PWC or other national seashore users because the ban has been in place since 2002. Therefore, there would be no change to visitor experience. Cumulative impacts would be adverse, short-term, and moderate due to continued and increased use of motorized boats.	Reinstating PWC use at Cape Lookout National Seashore would result in beneficial impacts on PWC users, but adverse, short- and long-term impacts on most nonmotorized boat users. Other boaters would also experience adverse impacts of lesser intensity if they perceive PWC use as a compatible boating alternative. Impacts would range from negligible to moderate depending on location. Cumulative impacts would be adverse, short- and long-term, and moderate due to expected increases in visitation.	Reinstating PWC use with restricted access would result in beneficial impacts on PWC users, but adverse, short- and long-term impacts on other boaters (motorized and nonmotorized) ranging from negligible to moderate depending on location and type of boat use. Cumulative impacts would be adverse, short- and long-term, and negligible due to the historically low numbers of PWC at the national seashore and additional PWC use restrictions.

Impact Topic	No-Action Alternative: Continue Prohibition of PWC Use in Cape Lookout National Seashore	Alternative A: Reinstate PWC Use under a Special NPS Regulation as Previously Managed	Alternative B: Reinstate PWC Use under a Special NPS Regulation with Additional Management Prescriptions (Preferred Alternative)
Visitor Conflicts and Safety	No conflicts or safety issues related to PWC use would occur under this alternative, resulting in no impacts. Cumulative impacts would be adverse, long-term, and of varying intensity depending upon location.	Impacts on visitor conflicts and safety due to reinstating PWC use throughout the national seashore would be adverse, short- and long-term ranging from negligible in the national seashore's north end to minor near the lighthouse. Cumulative impacts would be adverse, long-term and vary from negligible to moderate depending on location.	Reinstating PWC use in restricted areas would result in adverse, short- and long-term impacts that would vary from negligible in low-use areas, to minor in localized, high-use areas where a small number of visitors would be affected due the low numbers of PWC accessing the national seashore in restricted use areas. Cumulative impacts would be adverse, long-term and vary from negligible to moderate depending on location.
Cultural Resources	Continuing the ban on PWC use within national seashore waters would have no impacts on archaeological and submerged sites. Adverse cumulative impacts from illegal collecting, wave action from other boats, and wild horses would be long-term and negligible. Implementation of this alternative would not result in an impairment of cultural resources.	Reinstating PWC use is not expected to substantially affect the overall condition of archeological resources, resulting in adverse, long-term, negligible impacts. Cumulative impacts resulting from vandalism, illegal collecting, wave action from boats, and wild horses would be adverse, long-term, and negligible. Implementation of this alternative would not result in an impairment of cultural resources.	Restricting areas of use and requiring PWC to operate perpendicular to the shore and at flat-wake speed within the national seashore's jurisdiction would minimize impacts on archaeological resources from wave action. Restricting areas of use would also minimize impacts resulting from vandalism and illegal collecting. Cumulative impacts would be adverse, long-term, and negligible. Implementation of this alternative would not result in an impairment of cultural resources.
Socioeconomic Effects	There are no incremental benefits or costs associated with the no-action alternative. The primary beneficiaries of alternative A or B would be PWC users and the businesses that provide services to them. Additional beneficiaries include individuals who use PWC outside the park where displaced PWC users may decide to ride if the NPS ban continued. The primary group that would incur costs under alternative A or B is park visitors who do not use PWC and whose experiences would be negatively affected by PWC use within the park. Additionally, the public could incur costs associated with impacts from alternative A or B to other park values, such as noise and safety. However, because PWC users account for a very small fraction of economic activity in the region, it is very unlikely that there will be any measurable incremental impacts on the region's economy.		

Impact Topic	No-Action Alternative: Continue Prohibition of PWC Use in Cape Lookout National Seashore	Alternative A: Reinstate PWC Use under a Special NPS Regulation as Previously Managed	Alternative B: Reinstate PWC Use under a Special NPS Regulation with Additional Management Prescriptions (Preferred Alternative)
Cape Lookout National Seashore Management and Operations			
Conflicts with State and Local Ordinances and Policies	Discontinuing PWC use within the national seashore would not result in conflict with state PWC regulations. There are no national or local PWC regulations. Therefore, there would be no impacts (including cumulative impacts) related to such conflicts.	PWC and boating regulations within the national seashore would be the same as state regulations. Continued PWC use under alternative A would not result in conflicts with state regulations. Therefore, there would be no impacts (including cumulative impacts) related to such conflicts.	PWC and boating regulations within the national seashore would incorporate state regulations as well as special regulations specifically defined under this alternative. Continued PWC use under alternative B would not result in conflicts between state regulations and the additional restrictions defined under this alternative. Therefore, there would be no impacts (including cumulative impacts) related to such conflicts.
Impact to Park Operations from Increased Enforcement Needs	The no-action alternative would initially result in no impacts on park management and operations because the ban has been in effect since 2002. Park staff would not need to divert resources to focus on PWC-related activities, even though PWC use and related conflicts have been historically low. Cumulative impacts related to increased visitation would continue, but there would be no contribution from PWC use. Cumulative impacts would be adverse, long-term and minor to moderate given the current and expected staffing deficiencies.	Alternative A would have long-term, adverse, minor to moderate impacts on park management and operations due to increased enforcement needs related to reinstating PWC throughout the national seashore and insufficient staffing. Cumulative impacts would also be long-term, adverse, minor to moderate.	Alternative B would have short-term, moderate adverse impacts on park operations due to the additional duties that would be required by NPS staff to implement and enforce the new PWC regulations and to educate visitors. Long-term impacts would be reduced to minor as the public began to understand the new rules. Cumulative impacts would be minor to moderate due to expected increases in visitation.

TABLE 5: ANALYSIS OF HOW ALTERNATIVES MEET OBJECTIVES

Issue	Objective	No-Action Alternative: Continue Prohibition of PWC Use in Cape Lookout National Seashore	Alternative A: Reinstate PWC Use under a Special NPS Regulation as Previously Managed	Alternative B: Reinstate PWC Use under a Special NPS Regulation with Additional Management Prescriptions (Preferred Alternative)
Water Quality				
The majority of PWC in use today are still powered by conventional two-stroke, carbureted engines that discharge as much as 30% of their fuel directly into the water (NPS 1999; CARB 1999). Hydrocarbons, including BTEX and PAH are released, as well as MTBE. These discharges have potential adverse effects on water quality. PWC use at Cape Lookout has previously occurred along the western third of Shackleford Banks (Beaufort Inlet) and in Lookout Bight where high tidal flushing occurs. Areas such as the Core Sound where very little flushing occurs were infrequently used by PWC.	Maintain the waters of Core Sound as High Quality Waters. Core Sound is classified by the North Carolina Department of Environment and Natural Resources, Division of Water Quality as High Quality Waters, a classification intended to protect waters with quality higher than state water quality standards. Waters in Back and Core Sounds adjacent to Cape Lookout National Seashore are classified by North Carolina as having suitable water quality for shellfish harvesting. No waters surrounding Cape Lookout are under a fish consumption advisory, with the exception of the "no consumption" mercury advisory for large king mackerel along the southeast Atlantic coast (NCDHHS 2000).	Fully meets objective.	Fully meets objective.	Fully meets objective.
Some research shows that PAH, including those from PWC emissions, adversely affect water quality via harmful phototoxic effects on ecologically sensitive plankton and other small water organisms (EPA 1998a; Oris et al. 1998; Landrum et al. 1987; Mekenyan et al. 1994; Arfsten et al. 1996). This in turn can affect aquatic life and ultimately aquatic food chains. The primary concern is in shallow water ecosystems. Currently at Cape Lookout National Seashore, there is known information regarding emissions and increased phototoxicity. Conversely, some PAHs may be degraded via photodegradation or microbial degradation (Fasnacht and Blough 2002; Albers 2002).	Protect plankton and other aquatic organisms from PWC emissions and sediment disturbances so that the viability of dependent species is conserved.	Fully meets objective.	Meets objective. However, PWC that run parallel to the shoreline may occasionally disturb sediments.	Fully meets objective.

Issue	Objective	No-Action Alternative: Continue Prohibition of PWC Use in Cape Lookout National Seashore	Alternative A: Reinstate PWC Use under a Special NPS Regulation as Previously Managed	Alternative B: Reinstate PWC Use under a Special NPS Regulation with Additional Management Prescriptions (Preferred Alternative)
Multiple visitor uses, such as PWC use, boating, and swimming, occur in the same areas creating concerns that there could be human health effects related to PWC.	See Water Quality Objective description above.	Fully meets objective.	Fully meets objective.	Fully meets objective.
Air Quality				
Pollutant emissions, particularly nitrogen oxides and VOCs from PWC, may adversely affect air quality. These compounds react with sunlight to form ozone. To the extent that nitrogen loading in the air contributes to the nutrient loading in the water column, PWC use adversely affects water quality.	Manage PWC activity so that air emissions of harmful compounds do not appreciably degrade ambient air quality.	Fully meets objective.	Fully meets objective.	Fully meets objective.
Soundscapes				
PWC-generated noise varies from vessel to vessel. No literature was found that definitively described scientific measurements of PWC noise. Some literature stated that all recently manufactured watercraft emit fewer than 80 decibels at 50 feet from the vessel, while other sources attributed levels as high as 102 decibels without specifying distance. None of this literature fully described the method used to collect noise data.	Manage PWC use so that natural park soundscapes are infrequently affected by PWC noise in a minority of park acreage. PWC noise emissions are mostly confined to areas already experiencing noise from other non-natural sources.	Fully meets objective.	Does not meet objective in areas of concentrated PWC use where other recreationists may be sensitive to noise from PWC. Meets objective in other areas already experiencing noise from other non-natural sources.	Meets objective due to restricting areas of access and requiring flat-wake speed within park waters.

Issue	Objective	No-Action Alternative: Continue Prohibition of PWC Use in Cape Lookout National Seashore	Alternative A: Reinstate PWC Use under a Special NPS Regulation as Previously Managed	Alternative B: Reinstate PWC Use under a Special NPS Regulation with Additional Management Prescriptions (Preferred Alternative)
The NPS contracted for noise measurements of PWC and other motorized vessels in 2001 at Glen Canyon National Recreation Area (Harris, Miller, Miller & Hanson, Inc. 2002). The results show that maximum PWC noise levels at 25 meters (82 feet) ranged between 68 to 76 decibels on the A-weighted scale. Noise levels for other motorboat types measured during that study ranged from 65 to 86 decibels at 25 meters (82 feet). Noise limits established by the NPS require vessels to operate at less than 82 dB at 82 feet from the vessels.	In areas of dense visitor use, manage PWC noise such that the noise emissions are comparatively no greater than noise emissions from other watercraft or other sources.	Fully meets objective.	Meets objective. PWC historically comprised approximately 1% of overall visitation, and all visitors are required to access the islands by boat. Therefore, PWC noise would be no greater than emissions from other watercraft in areas of dense visitor use.	Meets objective for reasons described under alternative A and because of restricted access and flat-wake speed requirements defined under alternative B.
All motorized watercraft at Cape Lookout, including PWC, produce noise that may impact park soundscapes and visitor experiences. Any watercraft that does not meet the NPS watercraft noise regulation of 82 dB at 82 feet at full acceleration is subject to fine and removal from the park. However, PWC may be more disturbing than other motorized vessels because of rapid changes in acceleration and direction of noise. PWC-generated noise may also be perceived as more intrusive in areas of natural quiet such as the Drum Inlets and Portsmouth Village, although use may be infrequent in those locations. Conversely, in more congested and heavily visited areas such as Shackleford Banks and Cape Lookout, visitors would have a greater chance of perceiving and being disturbed by the higher number of PWC that often occur in these visitor areas.				

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Wildlife and Wildlife Habitat				
Some research suggests that PWC impact wildlife through interruption of normal activities, alarm or flight; avoidance and displacement of habitat; and effects on reproductive success. This is thought to be caused by a combination of PWC speed, noise, and ability to access sensitive areas. At Cape Lookout, PWC can access sensitive areas such as marshes and tidal flats, potentially disrupting riparian habitat areas critical to wildlife.	Protect the fish and wildlife species and habitats associated with the unique barrier island ecosystem found at Cape Lookout National Seashore, including those listed under the *Endangered Species Act* and similar statutes, from PWC disturbances that result in injury, changes in distribution and/or changes in population demographics.	Fully meets objective.	Meets objective to some degree. Reinstating PWC use in park waters is expected to have direct and indirect adverse impacts on terrestrial and aquatic wildlife species and habitats in areas where PWC land.	Meets objective. Reinstating PWC use with flat-wake speed and perpendicular approach restrictions would limit potential adverse impacts of PWC use to the 10 designated special use areas.
Excessive noise may force nesting birds at the national seashore, such as the piping plover, to abandon eggs during crucial embryo development stages and to flush other waterfowl from habitat in the marsh islands and at Portsmouth, Drum Inlets, and Power Squadron Spit causing stress and associated behavior changes. Noise from PWC and other boats, as well as the physical presence of the craft, might affect the distribution of birds such as shorebirds, raptors, and waterfowl.	Protect birds, waterfowl, and marine mammals from the effects of PWC noise, particularly during critical life stages.	Fully meets objective.	Does not meet objective in areas of concentrated PWC use. Meets objective in other areas already experiencing noise from other non-natural sources.	Meets objective due to restricting areas of access and requiring flat-wake speed within park waters.
PWC may have a greater impact on marine mammals, specifically dolphins that frequent the waters of the park, because of the PWC noise and speed. Although the full impact that noise has on marine mammals is not completely understood, the increase in man-made underwater noises could be a serious problem to their survival as it can interfere with their methods of communication and hunting strategy.	Protect birds, waterfowl, and marine mammals from the effects of PWC noise, particularly during critical life stages.	Fully meets objective.	Does not meet objective in areas of concentrated PWC use. Meets objective in other areas already experiencing noise from other non-natural sources.	Meets objective due to restricting areas of access and requiring flat-wake speed within park waters.

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Threatened and Endangered Species				
PWC users may affect federally listed sea turtles such as leatherbacks and marine mammals that access Back, Core, and Pamlico Sounds through the ocean inlets by colliding with them and harassing them, resulting in harm to the animal and in decreased distribution.	See Objective discussion under Wildlife and Wildlife Habitat.	See discussion under Wildlife and Wildlife Habitat.	See discussion under Wildlife and Wildlife Habitat.	See discussion under Wildlife and Wildlife Habitat.
Piping plovers may be affected by PWC noise and presence in areas such as New Drum Inlet during nesting and chick fledging. Other special concern species located at the national seashore include the northern right whale, humpback whale, Florida manatee, Kemp's Ridley, leatherback, green, and loggerhead sea turtles, American alligator, Carolina diamondback terrapin, Carolina water snake, Outer Banks kingsnake, roseate tern, American bald eagle, peregrine falcon, gull-billed tern, black skimmer, brown pelican, common tern, glossy ibis, least tern, little blue heron, loggerhead shrike, snowy egret, tricolored heron, and seabeach amaranth.	See Objective discussion under Wildlife and Wildlife Habitat.	See discussion under Wildlife and Wildlife Habitat.	See discussion under Wildlife and Wildlife Habitat.	See discussion under Wildlife and Wildlife Habitat.
Shoreline Vegetation and Submerged Aquatic Vegetation				
PWC users are able to access areas where most other motorcraft cannot go, which may disturb sensitive plant species. PWC and other watercraft are able to access areas such as tidal flats and marshes where sensitive vegetation and plant species exist.	Manage PWC use to protect sensitive coastal island areas such as marshes, tidal flats, and submerged aquatic vegetation from PWC activity and access.	Fully meets objectives.	Does not meet objectives. In landing areas shoreline vegetation may be trampled by foot, and submerged aquatic vegetation may be directly impacted by PWC or impacted by sediment resuspension.	Meets objectives due to flat-wake speed and perpendicular approach in the 10 designated special use areas only.

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Submerged aquatic vegetation is a diverse assembly of rooted macrophytes that grow in shallow water, under the surface, but not above it. These plants are beneficial to aquatic ecosystems because they provide a protective habitat for young and adult fish and shellfish, as well as food for waterfowl, fish, and mammals; and they aid in oxygen production, absorb wave energy and nutrients, and improve the clarity of the water. In addition, submerged aquatic vegetation beds stabilize bottom sediments and suspended sediments present in the water. PWC use has the potential to impact submerged aquatic vegetation because the craft can access shallow water environments. Direct impacts resulting from collision or mechanical removal can occur. PWC use may also affect the growth and health or submerged aquatic vegetation as a result of increased turbidity, decreased available sunlight, and deposition of suspended sediments on plants. However, impacts of PWC and other motorized watercraft on submerged aquatic vegetation beds are not known.				
Visitor Experience				
PWC are more likely than other watercraft to be operated for long periods of time within a confined area such as Shackleford Banks, degrading the experience of other visitors in the same area due to their noise and speed.	Manage PWC use to minimize potential conflicts between PWC use and visitors and to prevent degradation of the visitor experience associated with an undeveloped, remote barrier island.	Fully meets objective.	Does not meet objective. PWC use would not be managed to minimize potential conflicts under this alternative.	Meets objective in that PWC would be restricted to specific areas of the national seashore and would be required to operate perpendicular to the shoreline and at flat-wake speed, reducing the potential for conflicts with other visitors.

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At the national seashore, visitors have complained that PWC use conflicts with swimming, kayaking, and other beach activities. A goal of the national seashore is to provide visitors with opportunities for an isolated experience typical of a barrier island. PWC use near the shoreline of Shackleford Banks and Cape Lookout makes this difficult. Park staff observed that PWC operated for longer periods of time in areas of heavy visitor use at Shackleford Banks and within the Lookout Bight. These areas support other visitor activities such as boating, fishing, and camping. Visitors also travel via ferry to Cape Lookout to see the lighthouse and historic district. The greater number of PWC that have historically occurred in these areas (prior to the closure) and the heavy visitor concentrations during summer months creates a greater potential for conflict and for disturbance from PWC noise. Prior to closing to PWC, park visitors complained about safety and noise issues. Canoeists and kayakers, in particular, complained most frequently.				
Same issue statement as above.	Seek cooperation with local and state entities that manage or regulate PWC use in adjacent waters to minimize impacts on visitor experience within the park.	Fully meets objective.	Meets objective.	Meets objective.
Visitor Conflicts and Safety				
The National Transportation Safety Board reported that in 1996 PWC represented 7.5% of state-registered recreational boats, but accounted for 36% of recreational boating accidents. In the same year PWC operators accounted for more than 41% of people injured in boating accidents.	Minimize or reduce the potential for PWC user accidents.	Fully meets objective.	Does not meet objective. No action would be taken to minimize or reduce the potential for PWC user accidents.	Meets objective in that PWC would be restricted to specific areas of the national seashore and would be required to operate perpendicular to the shoreline and at flat-wake speed, reducing the

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PWC operators accounted for approximately 85% of the persons injured in accidents studied in 1997 (NTSB 1998). In part, this is believed to be a "boater education" issue, i.e., inexperienced riders lose control of the craft; yet it also is a function of the PWC operation, i.e., no brakes or clutch. When drivers let up on the throttle to avoid a collision, steering becomes difficult. PWC due to their maneuverability, ability to reach high speeds and access shallow-draft areas, can create wakes that pose a conflict and safety hazard to other users, such as canoeists and kayakers. At the national seashore, these issues were compounded by the fact that most PWC use was focused at the most heavily used areas in the parks – the western third of Shackleford Banks and Cape Lookout. During the year 2000, the occurrence of PWC was documented during routine patrols of the national seashore. Approximately 380 observations over 210 days occurred on the islands of the national seashore, during which a total of 523 PWC were noted operating within the park. Twelve of these PWC were observed committing some type of legal violation.				potential for PWC user accidents. Park staff would support the state's PWC boater education program.

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Since 2000, the park has not kept or noted PWC accidents or violations. Accident data provided by the park indicates that, during random patrols in 2001, there were no PWC-related accidents reported to the NPS. In 2002, one PWC user had to be evacuated to a local hospital because of back injuries sustained while crossing rough or high waves. PWC accidents or rescues are not likely to be reported through the NPS because most PWC operate outside of the NPS jurisdiction (150 feet from mean low water). The U.S. Coast Guard has documented few rescues in the last few years. Most accidents are likely handled outside of normal, official reporting and are probably not easily extractable.	Minimize or reduce the potential for safety conflicts between PWC users and park visitors.	Fully meets objective.	Does not meet objective. No action would be taken to minimize or reduce the potential for safety conflicts between PWC users and park visitors.	Meets objective in that PWC would be restricted to specific areas of the national seashore and would be required to operate perpendicular to the shoreline and at flat-wake speed, reducing the potential for conflicts between PWC users and park visitors. Park staff would support the state's PWC boater education program.
Cultural Resources				
Cultural resources that are listed on, or potentially eligible for listing on, the National Register of Historic Places may be affected by erosion along shorelines, or uncontrolled visitor access since riders are able to access / beach / launch in areas less accessible to most motorcraft. Cape Lookout has 36 recorded archeological sites within the national seashore. Infrequent monitoring is unlikely to prevent further deterioration from vandalism or looting activities. Monitoring is not effective in protecting sites from environmental elements changing the landscape of the barrier islands.	Manage PWC use and access to protect cultural resources, including sacred sites important to Native Americans.	Fully meets objective.	Does not meet objective. PWC use and access would not be managed to protect cultural resources.	Meets objective. PWC landing areas would be restricted, limiting areas of access. Flat-wake speed restrictions would also help protect cultural resources located along shorelines from PWC wave action.

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Socioeconomics				
PWC sales were once the fastest growing segment of the boating industry in the country. PWC rentals have also increased exponentially compared to other types of watercraft. Tourism is an extremely important part of Cape Lookout's local economy. Businesses that cater specifically to PWC users, such as rental shops and sales/service shops, could be directly affected by PWC use regulations at the national seashore. Other businesses, such as hotels and restaurants, could be indirectly affected by these regulations. However, PWC users comprised approximately only 1% of all national seashore visitors before the ban went into effect.	Enhance communications with local communities regarding the management of PWC.	Fully meets objective. PWC management actions would continue to be communicated to local communities.	Meets objective. PWC management actions would continue to be communicated to local communities.	Meets objective. PWC management actions would continue to be communicated to local communities.
Cape Lookout National Seashore Management and Operations				
PWC, because of their increased accident rates and visitor conflicts, often require additional park staff to enforce standards, limits, or closures. Currently, the national seashore does little or no water-based enforcement. PWC enforcement will divert resources from other high priority and under-staffed protection activities.	Minimize impacts on Cape Lookout National Seashore operations from increased enforcement needs.	Fully meets objective. No additional enforcement related to PWC would be required.	Meets objective to a large degree. Additional enforcement would be required to manage PWC use.	Meets objective to a large degree. Additional enforcement would be required to manage restricted PWC use and flat-wake speed requirements.

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Some state and local governments have taken action, or are considering taking action, to limit, ban, and otherwise manage PWC use. While the park may be exempt from these local actions, consistency with state and local plans must be evaluated. North Carolina has adopted PWC regulations since 2000 that govern PWC users within all the state waters surrounding and within the Cape Lookout barrier islands. These regulations dictate age limits and operational procedures for safe use. Because NPS boating regulations contained in 36 CFR adopt North Carolina state boating regulations, including PWC rules, the NPS enforces PWC in cooperation with the state. However, many local jurisdictions along the Outer Banks have adopted supplemental or more stringent PWC regulations.	Seek cooperation with local and state entities that manage or regulate PWC use.	Meets objective. State PWC regulations do not have provisions that forbid additional controls or bans; thus, prohibition of PWC use would not be in conflict with state regulations or policies. The no-action alternative would not be in conflict with national, federal, or state regulations or policies.	Meets objective. PWC users at the national seashore would be required to follow all applicable state regulations, as well as NPS regulations. Under this alternative NPS rangers would enforce all state regulations within the national seashore, and there would be no conflicts between park regulations and other regulations.	Meets objective. State PWC regulations do not have provisions that forbid additional controls or bans; thus, additional restrictions would not be in conflict with state regulations or policies. Alternative B would not be in conflict with national, federal, or state regulations or policies.

AFFECTED ENVIRONMENT

PHYSICAL CHARACTERISTICS

Cape Lookout National Seashore is a low, narrow, ribbon of sand running from Ocracoke Inlet on the northeast to Beaufort Inlet on the southeast. These barrier islands comprise a 56-mile long section of wide, bare beaches on the Outer Banks of North Carolina. The four undeveloped barrier islands that make up the national seashore — North Core Banks, South Core Banks, Middle Core Banks, and Shackleford Banks — are comprised of low dunes covered by scattered grasses, flat grasslands bordered by dense vegetation, and large expanses of salt marsh alongside the sound.

Coastal barrier islands, such as those located in Cape Lookout National Seashore, are unique land forms that provide protection for diverse aquatic habitats and serve as the mainland's first line of defense against the impacts of severe coastal storms and erosion. Located at the interface of land and sea, the dominant physical factors responsible for shaping coastal landforms are tidal range, wave energy, and sediment supply from rivers and older, pre-existing coastal sand bodies. Relative changes in local sea level also profoundly affect coastal barrier island diversity. Coastal barrier islands exhibit the following six characteristics (U.S. Fish and Wildlife Service [USFWS] 2000a):

- Subject to the impacts of coastal storms and sea level rise
- Buffer the mainland from the impact of storms
- Protect and maintain productive estuarine systems which support the nation's fishing and shellfishing industries
- Consist primarily of unconsolidated sediments
- Subject to wind, wave, and tidal energies
- Include associated landward aquatic habitats which the non-wetland portion of the coastal barrier island protects from direct wave attack

Coastal barrier islands protect the aquatic habitats between the barrier island and the mainland. Together with their adjacent wetland, marsh, estuarine, inlet, and nearshore water habitats, coastal barriers support a tremendous variety of organisms. Millions of fish, shellfish, birds, mammals, and other wildlife depend on barriers and their associated wetlands for vital feeding, spawning, nesting, nursery, and resting habitat.

Shackleford Banks contains the park's most extensive maritime forest as well as wild horses that have adapted to this environment over the centuries. The islands are an excellent place to see birds, particularly during spring and fall migrations. A number of tern species, egrets, herons, and shorebirds nest here. Loggerhead turtles climb the beaches at nesting time.

WATER RESOURCES

Sensitive aquatic systems around Cape Lookout National Seashore that may be affected by water quality include submerged aquatic vegetation and associated fauna, marshes, and nektonic communities (fish, shellfish, and marine reptiles and mammals). The following section describes existing water quality conditions that have a direct impact on these aquatic systems.

SURFACE WATER

As previously described, Cape Lookout National Seashore consists of four undeveloped barrier islands, Shackleford Banks, South Core Banks, Middle Core Banks, and North Core Banks, which are separated from the mainland by Back Sound and Core Sound. Barden Inlet, runs between Shackleford Banks and South Core Banks, New Drum Inlet runs between Middle Core Banks and South Core Banks and Old Drum Inlet runs between Middle Core Banks and North Core Banks. The NPS has legal jurisdiction over all waters from the mean low water line on the oceanside to 150 feet from the mean low water line on the soundside. At low tide, only the soundside waters are under the park's jurisdiction.

Core and Back Sounds are part of the Albemarle-Pamlico estuary system, which is the second largest estuary in the United States, draining a watershed of approximately 30,000 square miles. This estuary encompasses over 9,000 miles of freshwater rivers and streams and over 1.5 million acres of brackish, estuarine waters. There are five major river basins (Chowan, Roanoke, Pasquotank, Tar-Pamlico, and Neuse) that flow into the Albemarle-Pamlico system.

The Core and Back Sounds are very shallow in most areas adjacent to the park, averaging only 1 to 2 feet in depth at low tide. Tides are semi-diurnal (two tidal cycles per day), and the mean tidal range at Cape Lookout is 3.7 feet (NOAA 2002c), so the maximum depth of park waters is approximately 6 feet. There are navigational channels through the Core and Back Sounds, but these channels are only 5 to 10 feet deep. High tidal flushing occurs around the Beaufort and Ocracoke Inlets because they exceed 20 feet in depth, allowing tidal currents to reach speeds up to four knots (NOAA 2003). With Barden Inlet only 10 feet deep, and New Drum Inlet even shallower, the soundside of the North and South Core Banks has low tidal flushing.

The Albemarle-Pamlico estuary system has seasonal salinity cycles, with the highest salinity occurring from September to November, and the lowest from February to April (NOAA n.d.). During periods of high salinity, waters adjacent to the national seashore in Core and Back Sounds can have a salinity greater than 25 parts per thousand (ppt).

During low salinity periods, waters in Back Sound adjacent to the eastern half of Shackleford Banks and waters in Core Sound adjacent to South Core Banks have an average salinity of more than 25 ppt, but waters behind the western half of Shackleford Banks and waters in Core Sound adjacent to North Core Banks have an average salinity of 15 to 25 ppt. Annual ocean water temperatures off of the Outer Banks ranges from approximately 50° to 80°F (NOAA n.d.).

WATER QUALITY

Core Sound is classified by the North Carolina Department of Environment and Natural Resources, Division of Water Quality as High Quality Waters, a classification intended to protect waters with quality higher than state water quality standards. There are associated wastewater treatment and development controls for High Quality Waters enforced by the state. Core Sound is also designated as Outstanding Resource Waters, a classification intended to protect unique and special waters having excellent water quality and being of exceptional state or national ecological or recreational significance. No new or expanded wastewater discharges are allowed into Outstanding Resource Waters, and there are associated watershed stormwater controls enforced by the state.

Because the islands of Cape Lookout National Seashore are a mile or more from the mainland, and are undeveloped, the water quality has not been significantly impacted by human activities. The primary pollution sources include mainland urban stormwater and agricultural runoff, effluent from sewage

treatment plants and septic systems, recreational boating and marinas, and commercial shipping. Due to the proximity to the Intracoastal Waterway, Morehead City, and Beaufort, waters near Beaufort Inlet experience ship and boat traffic.

Waters in Back and Core Sounds adjacent to Cape Lookout National Seashore are classified by North Carolina as having suitable water quality for shellfish harvesting. Atlantic Ocean waters adjacent to the national seashore are state classified as being suitable for recreation and aquatic life propagation. No waters surrounding Cape Lookout are under a fish consumption advisory, with the exception of the "no consumption" mercury advisory for large king mackerel along the southeast Atlantic coast (NCDHHS 2000).

REGIONAL WATER QUALITY PROGRAMS

The park has very little information on water quality in Core and Back Sounds. Most water quality monitoring programs collect data such as water temperature, dissolved oxygen, nitrates, phosphates, pH and other similar constituents, but no water quality monitoring for hydrocarbon pollution has occurred within the park. Local and regional water quality monitoring programs are summarized below.

North Carolina Division of Water Quality Ambient Monitoring Network

The North Carolina Division of Water Quality performs monthly sampling in each of the state's 17 river basins. Core and Back Sounds fall under the White Oak River Basin, where the monitoring network monitors water quality at two stations adjacent to Harkers Island, one station at the entrance of Jarrett Bay, and one station at the entrance of Nelson Bay. Parameters measured include dissolved oxygen, pH, temperature, conductance, nutrients, chlorophyll, total suspended solids, turbidity, hardness, fecal coliform bacteria, and heavy metals. No hydrocarbon monitoring is conducted.

Albemarle-Pamlico National Estuary Program

The Albemarle-Pamlico National Estuary Program monitors ambient, surface water quality in the Albemarle-Pamlico estuary and its tributaries through its Citizens' Water Quality Monitoring Program. Volunteers in the program primarily monitor "vital signs" of the estuary. Specifically, dissolved oxygen, pH, salinity, air and water temperatures, and turbidity are monitored to gauge the general health or quality of water in the estuary. Occasionally, participants gather water samples for specific pollutants such as bacteria and nutrients. All data collected are forwarded to the program office and compiled in report form for citizen and government agency use. These monitoring efforts serve as useful supplements to existing governmental activities. This program does not perform hydrocarbon monitoring.

North Carolina National Estuarine Research Reserve

The Rachel Carson component of the North Carolina National Estuarine Research Reserve is located across Back Sound from Shackleford Banks. The National Estuarine Research Reserve (NERR) system conducts continuous water quality monitoring at stations in estuarine ecosystems to support state-specific non-point source pollution control programs and to develop a nationwide database on baseline environmental conditions in the NERR system of estuaries. Each NERR site collects water quality data in accordance with National Oceanic and Atmospheric Administration directives. Water quality parameters that are collected include water temperature, specific conductivity, salinity, dissolved oxygen, depth, pH,

and turbidity. Two water quality monitoring stations are located in the waters surrounding the Rachel Carson Reserve. No hydrocarbon monitoring is conducted at the reserve.

National Shellfish Sanitation Program

This program requires all coastal states involved in interstate shellfish harvest and sale to classify their coastal waters in order to safeguard the public health from the consumption of contaminated shellfish. Rules and regulations following national guidelines have been implemented to ensure the safety of harvesting waters and the proper sanitation of establishments which process shellfish and crustaceans for sale to the general public. The North Carolina Division of Marine Fisheries, Shellfish Sanitation Section, is responsible for the monitoring and classification of the state's shellfish growing waters. Water quality parameters monitored include salinity, temperature, and fecal coliform and enterococci bacteria. Areas with unsafe levels of bacteria are closed to shellfishing.

The Shellfish Sanitation Section also monitors coastal recreation waters for the presence of harmful bacteria to ensure that waters are safe for swimming. During the summer, 275 sites are tested on a weekly basis, less often off-season. When testing reveals water quality problems in an area, the county health department closes it to swimming. In the Cape Lookout area, there are stations near Shackleford Banks, and in Back and Core Sounds.

FEDERAL/STATE REGULATIONS AND STANDARDS

The Environmental Protection Agency has developed national recommended water quality criteria for priority pollutants in ambient water for the protection of aquatic life and human health (EPA 2002). These criteria have been adopted as enforceable standards by most states. The *Clean Water Act* and *Federal Pollution Control Act* regulate and protect all national waters. Under these laws all states must submit a 305(b) report, which characterizes the quality of their waters on a watershed level, and a 303(d) list, which establishes which specific water bodies do not meet the federal or state water quality standards for its designated use(s). The watersheds are rated as follows:

Category I:	Watersheds are in need of restoration and do not meet clean water and natural resource goals.
Category II:	Watersheds are meeting goals and may need action to maintain standards.
Category III:	Watersheds have pristine or sensitive aquatic conditions (most of these are designated as wilderness, wild and scenic rivers, or outstanding natural resource waters).
Category IV:	Watersheds do not have sufficient data to make an assessment.

The *Clean Water Act* requires that the surface waters of each state be classified according to designated uses. North Carolina's tidal saltwaters are classified with the following categories:

Class SC:	Secondary Recreation and Aquatic Life Propagation
Class SB:	Primary Recreation plus SC uses
Class SA:	Shellfishing for Market Purposes plus SC/SB uses

If a waterbody does not meet the state designated use standards, it is considered impaired and is placed on the 303(d) list. North Carolina's 303(d) list of impaired waters includes the waters of Core Sound as impaired due to fecal coliform bacteria with possible sources including septic systems, marinas, urban runoff, and agriculture (NCDNER 2000a). Atlantic Ocean waters are listed as impaired due to a mercury fish advisory. Waters in Core Sound are Class SA, suitable for shellfishing for market purposes as well as primary and secondary recreation, and aquatic life propagation. All SA waters are by definition also High Quality Waters, and, as previously mentioned, Core Sound is designated as Outstanding Resource Waters because of its exceptional ecological significance (see table 6).

AIR QUALITY

Cape Lookout National Seashore is subject to federal and State of North Carolina air regulations. National ambient air quality standards (NAAQS) have been established by the EPA. Current standards are set for sulfur dioxide (SO_2), CO, nitrogen dioxide (NO_2), ozone (O_3), particulate matter (PM) equal to or less than 10 microns in size (PM_{10}), fine PM equal to or less than 2.5 microns in aerodynamic diameter ($PM_{2.5}$), and lead (Pb). These pollutants are collectively referred to as criteria pollutants and are shown in table 7.

In August 2002, EPA proposed additional rules that would further reduce boating emissions. The proposal includes evaporative emission standards for all boats and would reduce emissions from fuel tanks by 80% (67 FR 157, August 14, 2002, pp. 53049-53115).

The Division of Air Quality (NCDAQ) within the North Carolina Department of Environmental and Natural Resources (NCDENR) is responsible for monitoring and evaluating ambient air quality within the state through a combination of state and federal regulations. The NCDAQ has adopted the national ambient air quality standards (NAAQS) except where noted in table 7.

No air quality monitoring stations are located within the park boundaries or in the adjacent coastal areas. Therefore, there is no representative quantitative data for the national seashore area. Monitoring in the state occurs principally in the more densely populated areas. Review of monitoring data for inland eastern North Carolina, and the absence of monitors in the coastal area implies that concentrations of the criteria pollutants in the Cape Lookout National Seashore area are well below standards (NCDAQ 2003a).

Areas are classified under the Federal *Clean Air Act* as either "attainment" or "non-attainment" areas for each criteria pollutant based on whether the NAAQS have been achieved or not. When an area has been designated as an attainment area after having been non-attainment, it is also classified as a maintenance area. Cape Lookout National Seashore is in an attainment area for all criteria pollutants (EPA 2003a).

TABLE 6: WATERBODY CLASSIFICATIONS AT CAPE LOOKOUT NATIONAL SEASHORE

Waterbody	Watershed	State Use Designation*	303(d) Listed Impairment	Federal Designation: EPA Watershed Category
Back/Core Sounds	Bogue-Core Sounds (03020106)	Class SA	Fecal Coliform	Category II
Atlantic Ocean	Bogue-Core Sounds (03020106)	Class SB	Fish Advisory-Mercury	Category II

NCDNER 2000a, 2000b; EPA 1998a, 1998b.

TABLE 7: NATIONAL AND NORTH CAROLINA[a] AMBIENT AIR QUALITY STANDARDS

Pollutant	Averaging Time	National Standard[b,c]		Purpose
		Primary[d,e]	Secondary[e,f]	
Carbon monoxide (CO)	1-hour 8-hour	35 ppm/ (40 mg/m^3) 9 ppm (10 mg/m^3)	— —	Prevent high levels of carboxy-hemoglobin
Nitrogen dioxide (NO_2)	Annual Arithmetic Mean	0.053 ppm (100 µg/m^3)	Same as primary	Prevent breathing difficulties, reduce smog and acid rain formation, and improve visibility
Particulate matter (PM_{10})	24-hour Annual Arithmetic Mean	150 µg/m^3 50 µg/ m^3	Same as primary	Prevent chronic diseases of the respiratory tract and improve visibility
Fine Particulate matter ($PM_{2.5}$)[f]	24-hour Annual Arithmetic Mean	65 µg/ m^3 15 µg/ m^3	Same as primary	Prevent chronic diseases of the respiratory tract and improve visibility
Ozone (O_3)[g]	1-hour[g] 8-hour	0.12 ppm (235 µg/ m^3) 0.08 ppm (157 µg/ m^3)	Same as primary	Prevent breathing difficulties, eye irritation, and biological effect on sensitive species
Sulfur dioxide (SO_2)	3-hour 24-hour Annual Arithmetic Mean	— 0.14 ppm (365 µg/ m^3) 0.03 ppm (80 µg/ m^3)	0.50 ppm (1,300 µg/ m^3) — —	Prevent increased respiratory damage, acid rain, and crop damage and to improve visibility
Lead (Pb)	Quarterly Average	1.5 µg/ m^3	Same as primary	Prevent impaired production of hemoglobin
Total Suspended Particulate	24-hour Annual Geometric Mean	No federal standard[7]		Prevent chronic diseases of the respiratory tract

Source: (EPA 2003d; EPA 2003e; EPA 2003f; NCDAQ 2003b)

µg/m^3 = micrograms per cubic meter; ppm = parts per million; dash (—) indicates no standard.

a. The North Carolina ambient air quality shall not exceed 75 micrograms per cubic meter annual geometric mean and 150 micrograms per cubic meter maximum 24-hour concentration not to be exceeded more than once per year for total suspended particulates.

b. National Ambient Air Quality Standards (other than O_3, PM, and those based on annual averages or annual arithmetic mean) are not to be exceeded more than once a year.

c. Annual standards never to be exceeded; short-term standards not to be exceeded more than once per year unless noted.

d. National Primary Standards: The levels of air quality necessary, with an adequate margin of safety, to protect the public health.

e. Concentration expressed first in units in which it was promulgated. Equivalent units given in parentheses are based upon a reference temperature of 25°C and a reference pressure of 760 millimeters (mm) of mercury. Most measurements of air quality are to be corrected to a reference temperature of 25°C and a reference pressure of 760 mm of mercury (1,013.2 millibar). Ppm in this table refers to ppm by volume or micromoles of pollutant per mole of gas.

f. National Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.

g. New federal 8-hour ozone and fine PM standards were promulgated by EPA on July 18, 1997. Subsequent litigation delayed implementation, although 8-hour O_3 averages are being calculated, and $PM_{2.5}$ monitoring networks are in place and growing. A federal appeals court decision on March 26, 2002 removed the last hurdles to implementation by the EPA. The EPA plans to make nonattainment area designations for $PM_{2.5}$ in December 2004, based on 2001-2003 data. A draft QA plan for implementation of the 8-hour O_3 standard indicates that attainment designation may occur in April 2004. The federal 1-hour O_3 standard continues to apply in areas that violated the standard.

Ambient air pollutant concentrations for the recreation area are within national and state air quality standards. This attainment status may be attributed to the rural location, lack of industry, and wind patterns in the Atlantic Ocean. Air-quality related values, scenic vistas, and pollution sensitive resources have not been identified for the recreation area.

The recreation area is designated a Class II airshed. This designation was established by Congress to facilitate the implementation of air quality provisions of the *Clean Air Act*. This designation allows a moderate increase in certain air pollutants. The *Clean Air Act* requires that the NPS comply with all federal, state, and local air pollution control laws (section 118) (EPA 2003b). The United States Fish and Wildlife Service manages Swanquarter National Wildlife Refuge, which is a Class I airshed, located approximately 150 miles north of Cape Lookout National Seashore (USFWS 2003; EPA 2003c).

The NPS maintains records of ozone levels measured as SUM06, which provide an indication of overall regional ozone exposure. The SUM06 data are based on the 3-month highest measured values averaged over a five-year period and obtained during daylight hours. Data compiled by NPS Air Resources Division show the SUM06 ozone index in the Cape Lookout National Seashore area at 0–8 ppm-hours.

Visibility, as indicated by fine PM less than 2.5 microns in aerodynamic diameter ($PM_{2.5}$) in the area of Cape Lookout National Seashore is generally good (NPS 2003b). In the eastern part of the United States, the principal contributor to reduced visibility is sulfates, which are principally formed from industrial emissions of SO_2. A secondary, but important contributor is fine PM less than 2.5 microns in aerodynamic diameter ($PM_{2.5}$) (EPA 2003g).

SOUNDSCAPES

One of the natural resources of Cape Lookout National Seashore is the natural soundscape, also referred to as “natural ambient sounds” or “natural quiet.” The natural soundscape includes all of the naturally occurring sounds of the national seashore, such as calling birds and the surf, as well as the quiet associated with still nights.

“Noise” is defined as unwanted sound. Sounds are described as noise if they interfere with an activity or disturb the person hearing them. When evaluated against the natural soundscape, which is all the sounds of nature in the absence of any human sound, all human sound is considered “noise.” This does not, however, imply that all human sounds are inappropriate or unacceptable; such evaluations must consider management guidance such as park purpose, management zoning, resource sensitivity, impacts from the activity, and similar factors.

Sound pressure levels are commonly measured in a logarithmic unit called a decibel (dB). The human ear is not equally sensitive to all sound frequencies, being generally less sensitive to very low and very high frequency sounds; therefore, the A-weighted decibel scale (dBA), which is calibrated to the human ear’s response, is often used in impact analysis. Table 8 illustrates common sounds and their associated sound levels using this scale.

For the average human a 10 dB increase in the measured sound level is subjectively perceived as being twice as loud, and a 10 dB decrease is perceived as half as loud. The decibel change at which the average human would indicate that the sound is just perceptibly louder or perceptibly quieter is 3 dB. There is generally a 6 dB reduction in sound level for each doubling of distance from a noise source due to spherical spreading loss (e.g., if the sound level at 25 feet from a PWC was 86 dB, the sound level at 50 feet would be expected to be 80 dB, at 100 feet 74 dB, etc.).

TABLE 8: SOUND LEVEL COMPARISON CHART

Decibels	How it Feels	Equivalent Sounds	Sound Levels at Various Locations in Cape Lookout National Seashore
140–160	Near permanent damage from short exposure	Large caliber rifles (e.g., .243, 30–06)	
130–140	Pain to ears	.22 caliber weapon	Permitted hunting on designated islands
100	Very loud	Air compressor at 20 feet; garbage trucks and city buses	Planes flying overhead near the west end of the national seashore
	Conversation stops	Power lawnmower; diesel truck at 25 feet	Boat congestion in Barden Inlet on Memorial weekend
90	Intolerable for phone use	Steady flow of freeway traffic; 10 HP outboard motor; garbage disposal	Standing near an SUV that is passing nearby on the oceanside of South Core Banks
80		Muffled PWC at 50 feet; automatic dishwasher; near drilling rig; vacuum cleaner	Standing on the beach on a windy day Touring Cape Lookout lighthouse on a busy day
70		Drilling rig at 200 feet; window air conditioner outside at 2 feet	Walking along the oceanside of Cape Point
60	Quiet	Window air conditioner in room; normal conversation	Sitting on Whale Creek on Shackleford Banks during a weekday
50	Sleep interference	Bird calls	Walking along the soundside of the national seashore's islands
40		Library	Viewing a soundside marsh
30		Soft whisper	In a tent on the soundside of North Core Banks after sundown
20		In a quiet house at midnight; leaves rustling	

Note: Modified from *Final Environmental Impact Statement, Miccosukee 3-1 Exploratory Well, Broward County, Florida* (U.S. Department of the Interior, n.d.).

As with all NPS resources, the opportunity to experience the natural soundscape is part of the visitor experience. The natural soundscape of Cape Lookout National Seashore contributes to a positive visitor experience and is a direct or indirect component of why many people visit the park. However, many visitors enjoy recreational activities using motorized watercraft and offroad driving, and noise is a component of that activity; such visitors do not necessarily visit Cape Lookout National Seashore solely for solitude or the soundscape. Visitor surveys regarding PWC noise in relation to visitor experience have not been conducted; therefore, it is difficult to quantify how many visitors enjoy the park for the natural soundscape compared to how many enjoy motorized recreational activities, or if some visitors enjoy both motorized activities and the natural soundscape. Information used in the analysis primarily comes from park staff observations.

Many factors affect how an individual responds to noise. Primary acoustical factors include the sound level, the distribution of sound levels across the frequency spectrum, and the duration (and other time-related factors such as how often it occurs, and timing sensitivity) of the sound. Secondary acoustical factors include the spectral complexity, sound level fluctuations, frequency fluctuation, rise-time of the noise, and localization of the noise source (Mestre Greve Associates 1992).

Non-acoustical factors also play a role in how an individual responds to sounds. Non-acoustical factors vary from the past experience and adaptability of an individual to the predictability of when a noise will occur. The listener's activity will also affect how he/she responds to noise.

PWC and outboard motors are similar in the actual noise level they generate (in terms of decibels), which is generally around 80 dB or less at 50 feet from a motorized boat or PWC (EPA 1974, cited in Izaak Walton League 1999) but can range from below 80 to as much as 102 dB (Sea-Doo 2000; Bluewater

Network 2001). However, unlike motorboats, PWC are highly maneuverable and are used for stunts and acrobatics, often resulting in quickly varying noise levels due to changes in acceleration and exposure of the jet exhaust when crossing waves. The frequent change in pitch and noise levels, especially if operated closer to land, make the noise from PWC more noticeable to human ears (Asplund 2001). At Cape Lookout, PWC are often used as transportation for accessing the islands, which can only be reached by boat. Few PWC have been observed performing stunts or acrobatics, although most are used along the national seashore for general recreational purposes (internal scoping meeting July 19, 2004).

NOISE EMISSION LEVELS — MARINE ENGINES

Studies and investigations by many organizations on different types of PWC have found that associated noise levels range from about 71 to 105 dB. A 1990 study in Salt Lake City, Utah, recorded PWC sound levels ranging from about 79 to 80.5 dB, where a conventional boat with an inboard engine and underwater exhaust may range from 74 to 83.5 dB (twin engine) and a conventional boat with an outboard engine has a sound level of about 88 dB (twin engine).

Research conducted by the Izaak Walton League indicates that one PWC unit can emit between 85 and 105 dB of sound, and that wildlife or humans located 100 feet away may hear sounds of 75 dB. This study also stated that rapid changes in acceleration and direction may create a greater disturbance and emit sounds of up to 90 dB (IWL 1999). Other studies conducted by the New Jersey State Police indicate that a PWC unit with a 100 horsepower engine emits up to 76 dBA, while a single, 175-horsepower outboard engine emits up to 81 dBA. Sea-Doo research indicates that in three out of five distances measured during a sound level test, PWC engines were quieter than an outboard motorboat. Sea-Doo also found that it would take approximately four PWC units, 50 feet from the shore to produce 77 dBA, and it would take 16 PWC vessels operating at 15 feet from the shore to emit 83 dBA of sound, which is equal to one open exhaust boat at 1,600 feet from the shore. In response to public complaints, the PWC industry has employed new technologies on PWC to reduce sound by about 50% to 70% from 1999 models (Sea-Doo 2000). Noise limits established by the NPS require vessels to operate at less than 82 dB at 82 feet from the vessel.

EPA research also indicated that one PWC unit operating 50 feet from an onshore observer emits a sound level of 71 dBA, and studies conducted using the Society of Automotive Engineers found that two PWC operating 50 feet from the shore emit similar sound levels of about 74 dBA (PWIA 2000).

AREAS SENSITIVE TO NOISE — CAPE LOOKOUT NATIONAL SEASHORE

Noise levels vary throughout the national seashore, with most noise concentrated on the west end of Shackleford Banks. Noise levels at this location are affected by visitors coming to the island from the population centers in the towns of Beaufort, Atlantic Beach, and Morehead City, which are directly north and northwest of the island's tip and are the only towns of substantial size within proximity of the national seashore. Several commercial ferries provide service from Beaufort, Morehead City and Harker's Island, and private docks exist along the towns' waterfront. Most of the national seashore's visitor use originates here; visitors concentrate in this area and filter eastward along the island. Man-made noise sources at the Beaufort Inlet area include powerboats, PWC, commercial vessels, background noise from the town of Beaufort, and small aircraft and military aircraft.

Another area popular with visitors is Cape Lookout, which includes a protected deep water anchorage adjacent to Power Squadron Spit on the southern tip of South Core Banks. This area of calm water brings visitors who are attracted to the lighthouse (which is currently closed to the public but will open to public

tours in 2005), as well as the other historic structures in the area. In addition, the protected, calm waters of Lookout Bight provide opportunities for fishing, swimming, and relaxing on the beaches formed along the Power Squadron Spit. Barden Inlet, which provides the majority of boat access to Cape Lookout, can be like a "highway" during holiday weekends (internal scoping meeting July 19, 2004).

Noise subsides farther north of Cape Lookout and is quietest along North Core Banks, which is the national seashore's farthest point from the mainland. Visitation here is about 50% less than at Shackleford (internal scoping meeting July 19, 2004). No towns of substantial size (such as Beaufort and Morehead City) exist along the Core Sound mainland, which adds to the overall quiet in this area, although Highway 70 parallels the coastline. Cedar Island National Wildlife Refuge exists west of Long Point, which provides a buffer against man-made sounds. The Great Island Ferry Landing, which is located on South Core Banks, provides several visitor services, and is likely the noisiest place along the Core Sound. A smaller ferry landing exists at Long Point, which is farther north. Although this landing also provides several visitor services, it can only accommodate up to four boats, indirectly restricting the amount of use in this area. The *Cape Lookout National Seashore: Superintendent's Compendium* (NPS 2003b) limits private boats docking at Long Point and Great Island boat basins, as well as those mooring at any national seashore docks, to a maximum of 15 minutes to load and unload passengers. Therefore, it is unlikely that many private boats would use the Long Point and Great Island boat basins for any purpose other than shuttling passengers, thereby limiting the number of private boats accessing these docks.

Few PWC used the extensive marshlands that lie along the soundside of South and North Core Banks when such use was permitted. Visitor use in these areas is low in general due to a lack of soundside beaches, a small number of cross-island trails, and a lack of highly populated adjacent communities. However, these marshlands are popular with sea kayaks and canoeists; such activity has been increasing at the national seashore (internal scoping meeting July 19, 2004).

Off-road vehicle use is permitted along the oceanside of South and North Core Banks, and hundreds of such vehicles travel this area per month (internal scoping meeting July 19, 2004). The *Cape Lookout National Seashore: Superintendent's Compendium* (NPS 2003b) limits operation of vehicles on the Core Banks to the oceanside beach below the primary dune line. Both South and North Core Banks include a designated vehicle route (Interior Route) that approximately parallels the center of the island and is connected to several other designated routes. Both islands also have designated parking areas. Portsmouth Village Historic District on North Core Banks and the Cape Lookout Light Station on South Core Banks are closed to all vehicular traffic. The soundside beaches and all of Shackleford Banks are also closed to off-road vehicles (*Cape Lookout National Seashore: Superintendent's Compendium* [NPS 2003b]).

The constant, dynamic sounds of the surf and winds are prevalent on the oceanside of all the national seashore's islands, creating a high amount of ambient noise. Few motorboats anchor on the oceanside due to difficulty of anchoring in rough surf. Similarly, few PWC have historically used the oceanside of the islands due to the surf's turbulence. The predominant sound along the oceanside of Shackleford is the surf. The same is true for the other islands, although the sound of slow-moving off-road vehicles is also heard (internal scoping meeting July 19, 2004).

Other park users contribute to the soundscape of Cape Lookout National Seashore, including beach users, campers, hunters, anglers, hikers, surfers, four-wheel drive enthusiasts, canoeists, and kayakers. However, visitors likely consider these sounds compatible with park uses.

VEGETATION

The barrier islands that comprise the North Core, Middle Core, and South Core Banks support a variety of vegetation ranging from salt marsh grasses to shrubs and trees. Extensive root systems of maritime grasses help to stabilize sediments, whether windblown or waterborne. The grasses themselves tend to trap windblown sand. In this way, dunes build naturally and the topography is elevated so that other forms of plant life can take root. Vegetation forms distinctive ecological zones across the barrier islands (*GMP Amendment* [NPS 2001a]).

The Core Banks is fairly uniform with a wide berm, low dunes, grasslands, and extensive salt marshes. Vegetation on Core Banks forms distinctive ecological zones across the island. Berms are comprised of sea oats and other plants, which trap enough sand at the driftline to form small dunes. Dunes are also formed by sea oats in overwash areas. The backside of the dunes may be heavily vegetated with vines such as Virginia creeper.

The beaches are void of vegetation except unicellular algae. Tidal flats contain a few strands of cordgrass at inlets. Woodlands exist on higher and protected lands, and are populated by live oak and southern red cedar. American holly is a component of the park's maritime forests, although live oak is primary species. Maritime forests are located only on Shackleford Banks and Guthries Hammock, which is south of the Great Island Ferry Landing on South Core Banks. Also, wax myrtle, yaupon, red cedar, and marsh elder form shrub thickets.

There are two types of grasslands, open grasslands and closed grasslands. Open grasslands contain salt meadow cordgrass and pennywort sparsely growing through sand deposited in overwash areas. Closed grasslands are dominated by denser stands of salt meadow cordgrass, pennywort, broomsedge, and hairgrass. Rushes grow in areas with a higher water table.

SHORELINE VEGETATION AND SUBMERGED AQUATIC VEGETATION

Salt marshes are a dominant landscape feature on the soundside, and their function in maintaining a healthy ecosystem, values for wildlife habitat, and benefit to humans is well documented. They generally exist in the intermittently flooded area between mean sea level and the average spring high tide. The predominant vegetation is composed of dense stands of smooth cordgrass. Salt marshes are dependent upon the cyclic inundation to accumulate peat, sediments, and nutrients. Tidal action also prevents the invasion of upland species and therefore maintains monotypic stands of cordgrass. High salt marshes are flooded in spring and during storm tides and are dominated by black needlerush and salt meadow cordgrass. Low salt marshes are dominated by salt marsh cordgrass and are flooded at mean low tide.

Submerged aquatic vegetation is a diverse assembly of rooted macrophytes that grow in shallow water, under the surface, but not above it. Under federal regulations, submerged aquatic vegetation beds are considered special aquatic sites (40 CFR 230 sec. 404 (b)(1) *Guidelines – Protection of Wetlands and other Waters of the U.S.*). At Cape Lookout National Seashore, submerged aquatic vegetation beds are composed of several species of seagrasses. Their deep-rooted rhizome system makes seagrasses very important in stabilizing bottom sediments and improving water clarity by trapping the fine particles that would otherwise remain suspended by wave and current action. Seagrasses bind shallow water sediments with their roots and rhizomes and baffle wave and current energy with their leafy canopy. The physical stability, reduced mixing, and shelter provided by seagrasses provide for a highly productive system.

Seagrasses form the basis of the food web in clear water systems, where they uptake dissolved nutrients and convert them to plant biomass. They provide important nursery habitat for larval and juvenile stages

of many fish and shellfish species because the vegetation helps to reduce current velocities, provides an attachment surface, reduces turbidity, and provides refuge and food. Seagrass beds are feeding habitats for many species of fish, turtles, and waterfowl. Seagrass health and acreage is directly proportional to the health and status of many commercially and recreationally important seafood species at Cape Lookout such as shrimp, crabs, scallops, red drum, speckled trout, and mullet.

Factors that limit seagrass distribution include low salinity, high turbidity, and high wave energy. The extent of seagrass beds naturally fluctuates over time (Fonseca et al. 1998). Depending on the species and the physical setting, the rate at which portions of the seafloor switch from vegetated to unvegetated may vary on the scale of days and/or decades; therefore the amount of open seafloor bottom required to maintain patchy seagrass beds is greater than the coverage by the seagrass itself at any one point in time, sometimes by a factor of two (Fonseca et al. 1998). Seagrass habitat should be recognized as including not only beds of continuous cover, but chronically patchy habitat (Fonseca et al. 1998).

There is limited information on the coverage of submerged aquatic vegetation in North Carolina, but anecdotal information indicates that the coverage of seagrass beds has declined significantly from historic levels, particularly in the rivers, creeks, and western sounds. As human populations in coastal areas increase, the anthropogenic impacts on seagrass beds increase through nutrient enrichment and suspended sediment loading from runoff; light reduction from increased turbidity and phytoplankton blooms; increased boat traffic; and more direct impacts such as trawling, clam dredging, and propeller scarring. Trawling is prohibited in seagrass beds adjacent to Cape Lookout (Trish Murphey, North Carolina Division of Marine Fisheries [NCDMF], pers. comm. 5/19/2003). Dredge and fill activities have also been recognized as a major factor in the loss of seagrass beds.

In Back and Core sounds, seagrass beds located in protected shallow waters are dominated by eelgrass, shoal grass, and widgeon grass, a mixture of species found only in North Carolina (*GMP Amendment* [NPS 2001a]). Between 1985 and 1992, the National Marine Fisheries Service's Beaufort Laboratory conducted aerial photography of the coastal waters of North Carolina for mapping and monitoring submerged aquatic vegetation beds (NOAA n.d.). Within the Cape Lookout National Seashore jurisdictional waters, seagrass acreage based on the National Oceanic and Atmospheric Administration's mapping includes 980 acres at Shackleford Banks, 1,100 acres at South Core Banks, and 130 acres at North Core Banks.

NOXIOUS WEEDS

The common reed, an exotic plant which grows in marshes and other wet environments, has been documented in the park (NPS 2000d).

WILDLIFE AND WILDLIFE HABITAT

AQUATIC WILDLIFE

The shallow sounds lying behind North Carolina's strand of barrier islands forms the largest and most productive estuarine system of any state on the eastern seaboard of the United States. North Carolina is home to a tremendous variety of fish, shellfish, and other aquatic wildlife largely because of the state's great expanse and diversity of coastal habitats required for the feeding, growth, and reproduction of these marine animals. North Carolina has over 2 million acres of marine and brackish waters, which are vital nursery grounds for fish and shellfish species. More than 90% of the commercial fish species caught in North Carolina spend some part of their lives in an estuary. The state's estuary system is the economic

foundation of the coastal area, supporting commercial and recreational fisheries that contribute a billion dollars a year to the state's economy (NCDMF n.d.). At Cape Lookout National Seashore, aquatic habitats such as tidal flats, sheltered coves, salt marshes and seagrass beds provide food and shelter for fish, shellfish, and other aquatic wildlife. Aquatic species discussed below include those present in the jurisdictional waters of Cape Lookout National Seashore. Threatened and endangered aquatic species are discussed in a separate section.

Marine Mammals

A wide variety of marine mammals occur in the waters off of North Carolina's outer banks. Because Cape Lookout National Seashore has over 50 miles of beaches on the Atlantic Ocean, the stranding of live and dead marine mammals is not unusual. Between 1986 and 2001, twenty species of marine mammals, including toothed and baleen whales, porpoises, dolphins, and seals have stranded at Cape Lookout (NPS n.d.), the majority of which normally occur offshore, outside of park waters and wash ashore on the oceanside of the cape. Because the waters of Back and Core sounds are very shallow (waters in the park's jurisdiction are generally less than 10 feet deep), few marine mammal species venture into these waters. Bottlenose dolphins are commonly found in the sounds, while harbor seals, hooded seals, and manatees are occasionally reported (Keith Rittmaster, Cape Lookout Studies Program, pers. comm. 5/19/2003). Humpback and right whales are reported in Lookout Bight from time to time, and are discussed in the "Threatened, Endangered, or Special Concern Species" section later in this chapter. Under the *Marine Mammal Protection Act of 1972*, it is unlawful to harass, hunt, capture, or kill any marine mammal.

Bottlenose dolphins are the most common marine mammal in the coastal and estuarine waters near Cape Lookout. The National Marine Fisheries Service listed bottlenose dolphins as depleted in 1993 under the *Marine Mammal Protection Act*, following a die-off that killed a significant portion of the bottlenose dolphin population. Dead dolphins regularly wash up on North Carolina beaches, showing evidence of having been struck by boats, entangled in fishing nets, and having ingested trash. Researchers at the North Carolina Maritime Museum's Cape Lookout Studies Program have been using photo-identification since 1985 to study the local bottlenose dolphins.

Monitoring has allowed the presence and movements of individual dolphins to be tracked as far away as central Florida and Long Island, New York. The Maritime Museum is also studying association patterns and reproductive rates of known dolphins.

Bottlenose dolphins are common in the sounds during the months from September to April when the water is cool. They are seen in the shallow waters of the sounds adjacent to Cape Lookout, but are more common in the channels and deeper areas. Groups of up to 50 have been spotted in Lookout Bight, and groups of 250 have been sighted in ocean waters surrounding the park. In Lookout Bight, just west of Power Squadron Spit is a 20- to 30-feet deep area close to shore where groups of dolphins are common. The park does not monitor bottlenose dolphins.

In recent years, a few harbor seals and hooded seals have been reported at Cape Lookout during the winter months (Keith Rittmaster, pers. comm. 5/19/03). These seals were formerly hunted as nuisance animals, but since the *Marine Mammal Protection Act* was passed, their population has increased dramatically, and their range has expanded into the Carolinas. These seals have occasionally been observed hauled out on beaches at the park, resting and warming themselves in the sun. Seals tend to haul out in remote areas where they are isolated from human activity, and quickly return to the water when disturbed by a close passing boat. Both harbor and hooded seals have stranded in the park in recent years. The park does not have monitoring data on the presence of seals at Cape Lookout.

TERRESTRIAL MAMMALS

Upland animal species are somewhat limited in number on barrier islands due to the lack of diversity in vegetation and difficulty of access from mainland areas. The only large animal present in the national seashore are the feral horses on Shackleford Banks. Shackleford Banks is home to 110–130 feral horses, which are protected and maintained according to the park's federal legislation. Management of the feral horses includes monitoring population growth and mortality. During horse roundups, selected individuals are removed and adopted to the public or donated to other wild herds (NPS 2004).

Common smaller native species found in the national seashore include marsh rice rats, river otters, and raccoons (Cape Lookout National Seashore website). Shackleford Banks also has, eastern mole, marsh rabbit, and eastern cottontail. Both the South and North Core Banks are home to the least shrew, while the South Core Banks support the northern short-tailed shrew, and the North Core Banks the eastern cottontail.

In addition to the common mammals listed above, the following nonnative species are also present within the national seashore: nutria, house cat, house mouse, and the Norway rat.

AMPHIBIANS AND REPTILES

Even though the harsh environment precludes large numbers and diversity of species, other animals found on the islands include amphibians and reptiles such as tree frogs, toads, turtles, and snakes (*GMP Amendment* [NPS 2001a]; see table 9).

TABLE 9: REPTILES AND AMPHIBIANS DOCUMENTED IN CAPE LOOKOUT NATIONAL SEASHORE

Amphibians		
Fowler's toad	Squirrel treefrog	Eastern spadefoot toad
Oak toad	Little grass frog	Mabee's salamander
Eastern narrowmouth toad	Southern leopard frog	Red spotted newt
Green treefrog		
Reptiles		
Common snapping turtle	Green anole	Eastern hognose snake
Spotted turtle	Six-lined racerunner	Eastern kingsnake
Eastern mud turtle	Southeastern five-lined skink	Banded water snake
Diamondback terrapin	Eastern glass lizard	Northern banded water snake
Eastern box turtle	Ground skink	Rough green snake
Loggerhead sea turtle	Cottonmouth snake	Pine woods snake
Leatherback sea turtle	Black racer	Pigmy rattlesnake
Green sea turtle	Rat snake	Ribbon snake

Source: University of Georgia 2004.

AQUATIC INVERTEBRATES AND FISH

The marine and estuarine waters of Cape Lookout contain a wide variety of fish and shellfish. The park has little data on the species of fish known to occur at Cape Lookout National Seashore, but the following species have been documented: ladyfish, American eel, Atlantic menhaden, sheepshead minnow, marsh killifish, mummichog, spotfin killifish, striped killifish, rainwater killifish, western mosquitofish, inland silversides, Atlantic silversides, striped mullet, and basking shark (NPS 1977, Schwartz 1982). A search of the NPS species database (Jeff Cordes, pers. comm. 11/20/2002) revealed the presence of the following additional species: Atlantic flying fish, bonnethead shark, blueback herring, hickory shad, alewife, American shad, gizzard shad, eastern mosquitofish, striped bass, spot, grass pickerel, and longnose gar. The same database search listed over 200 additional species as probably present at the park. Fish commonly targeted by commercial and recreational fishermen in inshore waters around Cape Lookout include Spanish mackerel, king mackerel, speckled trout, weakfish, jack, bluefish, cobia, tarpon, striped bass, kingfish, black sea bass, red drum, black drum, croaker, gray snapper, summer flounder, and mullet. Shellfish of economic significance include the hard clam, oyster, bay scallop, shrimp, and blue crab.

Shellfish of Particular Significance

The blue crab is one of the most common estuarine crabs in the southeastern United States. Found throughout North Carolina's coastal waters, the largest populations of this swimming crab occur in Albemarle and Pamlico sounds. The blue crab requires both inshore brackish waters and high salinity ocean waters to complete its life cycle. Mating generally occurs in brackish water, after which females migrate to higher salinity water in the lower reaches of the estuary or in the ocean, carrying their eggs under the abdomen until they hatch. The blue crab has an important role in the estuarine food web, providing prey for many species and being a voracious predator of fish, oysters, clams, snails, shrimp, worms and other crabs. The blue crab is edible and supports large commercial and recreational fisheries. North Carolina is the nation's largest producer of blue crabs, and it is the state's most valuable commercial fishery, with landings of over 30 million dollars in 2002 (NCDMF 2003a).

Three species of shrimp are commercially targeted in the Albemarle-Pamlico estuary system-brown, pink, and white shrimp. All three shrimp spawn in the ocean but spend much of their lives as juveniles and adults in the shallow sound waters. Brown shrimp, which are generally caught in the summer, are North Carolina's most abundant shrimp species and account for two-thirds of the state's shrimp landings. Pink shrimp are harvested in the spring and the fall, and comprise about one-quarter of the state's shrimp catch. White shrimp, or green tails, are harvested primarily in the fall and make up less than one-tenth of North Carolina's shrimp landings. Total shrimp landings in North Carolina in 2002 were valued at more than 18 million dollars (NCDMF 2003a).

The horseshoe crab is a benthic arthropod inhabiting estuarine and continental shelf habitats from Maine to the Gulf of Mexico. While the horseshoe crab is not of great economic significance, it plays a critical ecological role in coastal habitats of the mid-Atlantic region. Each spring, adults migrate inshore to sheltered estuarine environments to spawn at the high tide line of sandy beach habitats. The resulting abundance of horseshoe crab eggs serves as a critical food source for a number of shorebird species, especially during long migrations to northern breeding grounds. Juvenile and adult horseshoe crabs are also an important food source for Atlantic loggerhead turtles. Horseshoe crabs are commercially harvested for the biomedical industry and as bait for the eel and conch fisheries, but because horseshoe crabs are slow to mature and have mass-spawning events, they are particularly sensitive to harvest pressure. Recent increases in the horseshoe crab harvest prompted the Atlantic States Marine Fisheries Commission to produce an *Interstate Fishery Management Plan* for the horseshoe crab in 1998, which contains spawning habitat monitoring requirements as well as harvest reductions for all Atlantic coast

states. Very little information is currently available on horseshoe crab spawning and nursery habitat in North Carolina. Observations by NCDMF Marine Patrol officers, NPS rangers, North Carolina Aquariums personnel, Rachael Carson Estuarine Reserve personnel, and commercial fishermen suggest that the soundside of Cape Lookout National Seashore may be spawning habitat and that Back Sound may be a nursery area (NCDMF 2003b). No spawning habitat monitoring has been conducted at Cape Lookout, but spawning has been reported at nearby Bird Shoal in the Rachael Carson Estuarine Reserve (Trish Murphey, NCDMF, pers. comm. 5/19/03).

Essential Fish Habitat

The 1996 *Magnuson-Stevens Act* requires cooperation among the National Marine Fisheries Service (NMFS), fishing participants, and federal and state agencies to protect, conserve, and enhance essential fish habitats. Essential fish habitat (EFH) is defined as those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (16 USC 1802(10)). EFH has not been designated for most fish and shellfish species in the South Atlantic, nor has it been designated for specific life stages; however EFH for red drum and shrimp does occur in the Cape Lookout area.

At Cape Lookout, EFH for red drum includes estuarine emergent vegetated wetlands (flooded salt marshes, brackish marshes, and tidal creeks), submerged aquatic vegetation, oyster reefs and shell banks, unconsolidated sediments, and high salinity surf zones (SAFMC 1998). For shrimp, EFH in the Cape Lookout area includes inshore nursery areas including salt marshes and seagrass beds, subtidal and intertidal non-vegetated flats, and all water bodies connecting these areas with offshore marine habitats used for spawning and growth to maturity (SAFMC 1998). EFH areas that meet the criteria for habitat areas of particular concern for shrimp (brown, pink, and white shrimp) include all coastal inlets, all state-designated nursery habitats (see below), and overwintering areas.

While EFH has not yet been designated for most species in the South Atlantic, the National Oceanic and Atmospheric Administration's Biogeography Program has developed a database containing the relative abundance of ecologically and economically important fishes and invertebrates in the nation's estuaries. The relative abundance of key fish and shellfish species in the estuarine waters of North Carolina has been mapped (NOAA 2002a). The Pamlico estuary system has seasonal salinity cycles, with the highest salinity occurring from September to November, and lowest salinity occurring from February to April (NOAA n.d.). The relative abundance of juveniles of seven species of fish and shrimp in Back and Core sounds in each salinity season is shown in table 10.

Nursery Areas

To protect fish and shellfish nursery areas, North Carolina has designated Primary and Secondary Nursery Areas that generally occur in tributary creeks and embayments, where shallow, low to mid-salinity waters lay over muddy or grassy bottoms. These nursery areas are of critical importance to the propagation of many economically significant fish and shellfish species in North Carolina and along the east coast. Nursery areas are generally protected from potentially harmful water uses including development activities and some commercial fishing practices such as trawling, seining, and dredging are prohibited. The functions of nursery areas are most threatened by nonpoint sources of pollution and development on land near nursery areas. No primary or secondary nursery areas have been designated along Cape Lookout, but seagrass beds in Core and Back Sounds adjacent to the park are closed to trawling (Trish Murphey, NCDMF, pers. comm. 5/19/2003).

TABLE 10: RELATIVE ABUNDANCE OF JUVENILES OF KEY SPECIES IN BACK AND CORE SOUNDS

Species	Area	Salinity Time Period*			
		Increasing (May–Aug)	**High** (Sept–Nov)	**Decreasing** (Dec–Jan)	**Low** (Feb–April)
Brown Shrimp	Back Sound	Highly abundant	Highly abundant	Highly abundant	Rare
	Core Sound	Highly abundant	Highly abundant	Rare/not present	Common/abundant
Pink Shrimp	Back Sound	Common	Abundant	Abundant	Common
	Core Sound	Abundant	Abundant	Common	Common
White Shrimp	Back Sound	Not present	Common	Common	Not present
	Core Sound	Common	Common	Not present	Not present
Cobia	Back Sound	Common	Common	Common	Not present
	Core Sound	Common	Common	Not present	Not present
Gray Snapper	Back Sound	Not present	Common	Common	Not present
	Core Sound	Common	Common	Not present	Not present
Red Drum	Back Sound	Common	Common	Abundant	Common
	Core Sound	Common	Abundant	Common	Common
Spanish Mackerel	Back Sound	Not present	Common	Common	Not present
	Core Sound	Common	Common	Not present	Not present

Source: NOAA 2002a.

*All waters in Back and Core sounds adjacent to the park have a salinity greater than 25 parts per thousand (ppt) during both the high and low salinity periods, except for waters in Back Sound adjacent to the western half of Shackleford Banks and waters in Core Sound adjacent to North Core Banks, which have a salinity of 15 to 25 ppt during the low salinity period.

BIRDS

Cape Lookout National Seashore has nearly 275 species of birds that use the islands for resting, nesting, and feeding, and as wintering or migratory rest-stops and is designated as a Globally Important Bird Area by the American Bird Conservancy. These birds include songbirds, waterfowl, wading birds, birds of prey, marine birds, and shorebirds. The northern gannet, willet, sanderling, piping plover, great black-backed gull, royal tern, common nighthawk, great blue heron, red-winged blackbird, eastern meadowlark, and song sparrow are just a few of the birds which inhabit the national seashore (table 11). The abundance and variety of birds is due to the national seashore's location on the Atlantic Flyway and to the lack of development and human disturbance. The ring-necked pheasant, which is a favorite with some hunters, is an exotic species that exists in the shrub thickets on Core Banks (*GMP Amendment* [NPS 2001a]).

THREATENED, ENDANGERED, OR SPECIAL CONCERN SPECIES

The U.S. Fish and Wildlife Service lists species as threatened or endangered when they are deemed to meet criteria detailed under the *Endangered Species Act of 1973*. In addition, candidate species are designated when there is adequate information regarding threats or vulnerability to warrant issuance of a proposed rule to list, but circumstances preclude rule issuance. Special concern species include state special concern species, which are those species that require monitoring but may be collected or sold under special regulations.

Wildlife species listed by the U.S. Fish and Wildlife Service in North Carolina as threatened, endangered, or special concern species, which may occur in or near the Cape Lookout National Seashore are listed in table 12.

TABLE 11: GENERAL SEASONAL ABUNDANCE

Season	Common Species
Spring (March–May)	Brown Pelican, Herring Gull, mourning dove, red-winged blackbird, eastern meadowlark, sandwich tern, common tern, least tern, barn swallow, American wigeon, northern gannet, great egret, snowy egret, little blue heron, tricolored heron, royal tern, sanderling
Summer (June–August)	Brown Pelican, Herring Gull, mourning dove, red-winged blackbird, eastern meadowlark, sandwich tern, common tern, least tern, barn swallow, great egret, snowy egret, little blue heron, tricolored heron, royal tern, sanderling
Fall (September–November)	Brown Pelican, Herring Gull, mourning dove, red-winged blackbird, eastern meadowlark, sandwich tern, common tern, American wigeon, northern gannet, great egret, snowy egret, little blue heron, tricolored heron, palm warbler, royal tern, sanderling
Winter (December–February)	Brown Pelican, Herring Gull, mourning dove, red-winged blackbird, eastern meadowlark, American wigeon, northern gannet, yellow-rumped warbler, Bonaparte's gull, red-breasted merganser, gadwall, sanderling

TABLE 12: FEDERAL AND STATE LISTED WILDLIFE IDENTIFIED IN CAPE LOOKOUT NATIONAL SEASHORE

Common Name	Scientific Name	Federal Status	State Status
Marine Mammals			
Finback whale	*Balaenoptera physalus*	Endangered	Endangered
Northern right whale	*Eubalaena glacialis*	Endangered	Endangered
Humpback whale	*Megaptera novaengliae*	Endangered	Endangered
Florida manatee	*Trichechus manatus latirostris*	Endangered	
Sperm whale	*Physeter catodon*	Endangered	Endangered
Aquatic Reptiles			
Kemp's ridley sea turtle	*Lepidochelys kempi*	Endangered	Endangered
Leatherback sea turtle	*Dermochelys coriacea*	Endangered	Endangered
Green sea turtle	*Chelonia mydas*	Threatened	Threatened
Loggerhead sea turtle	*Caretta caretta*	Threatened	Threatened
American alligator	*Alligator mississippiensis*	Threatened (similar in appearance)	Threatened
Terrestrial Reptiles			
Carolina diamondback terrapin	*Malaclemys terrapin centrata*		Special concern
Carolina water snake	*Nerodia sipedon williamengelsi*		Special concern
Outer Banks kingsnake	*Lampropeltis getula sticticeps*		Special concern
Birds			
Roseate tern	*Sterna dougallii*	Endangered	Endangered
American bald eagle	*Haliaeetus leucocephalus*	Threatened	Threatened
Piping plover	*Charadrius melodus*	Threatened	Threatened
Peregrine falcon	*Falco peregrinus*		Endangered
Gull-billed tern	*Sterna nilotica*		Threatened
Black skimmer	*Rynchops niger*		Special concern
Brown pelican	*Pelecanus occidentalis*		Special concern
Common tern	*Sterna anitllarum*		Special concern
Glossy ibis	*Plegadis falcinellus*		Special concern
Least tern	*Sterna antillarum*		Special concern
Little blue heron	*Egretta caerulea*		Special concern
Loggerhead shrike	*Lanius ludovicianus*		Special concern
Snowy egret	*Egretta thula*		Special concern
Tricolored heron	*Egretta tricolor*		Special concern
Terrestrial Plants			
Seabeach amaranth	*Amaranthus pumilus*	Threatened	Threatened

Source: North Carolina Natural Heritage Program.

MARINE MAMMALS

While the fin and sperm whales are endangered, they are not known to occur live in park waters. As mentioned under the Marine Wildlife section, a wide variety of marine mammals occur in the waters off of North Carolina's outer banks. Because Cape Lookout National Seashore has over 50 miles of beaches on the Atlantic Ocean, the stranding of live and dead marine mammals is not unusual. Between 1986 and 2001, twenty species of marine mammals, including whales, have stranded at Cape Lookout (NPS n.d.), the majority of which normally occur offshore, outside of park waters and wash ashore on the oceanside of the cape. Because the waters of Back and Core sounds are very shallow (waters in the park's jurisdiction are generally less than 10 feet deep), few marine mammal species venture into these waters.

Occasionally, a right whale or humpback whale ventures into Cape Lookout Bight during the winter months (Keith Rittmaster, Cape Lookout Studies Program, pers. comm. 5/19/2003). The northern right whale is the most imperiled large whale in the world, and is listed as federally endangered (USFWS 2003). Intense commercial whaling is primarily responsible for the population decline of this baleen whale, which presently consists of approximately 300 individuals. Current threats to right whales include entanglement in commercial fishing gear and collisions with ships. Northern right whales live in the Atlantic Ocean off the U.S. and Canadian east coasts, and congregate in waters off the southeast U.S. during the winter, where they give birth and nurse their young before heading to northern feeding grounds in the spring.

Like the right whale, the humpback was killed in great numbers by the whaling industry and is federally endangered (USFWS 2003). The humpback whale occurs off of the southeastern U.S. during the winter months, generally south of the Carolinas, and migrates to northern feeding grounds off of the New England and Canadian east coast in the spring.

The Florida manatee has occasionally been sighted in waters near Cape Lookout, with individual manatees having been reported at Beaufort, Morehead City, and Taylor Creek in recent years (Keith Rittmaster, Cape Lookout Studies Program, pers. comm. 5/19/2003). Satellite tagging has revealed that some manatees travel through Bogue, Back, and Core sounds on summer migrations to Chesapeake Bay. In the 19th century, the manatee was hunted for its meat and oils in the U.S., resulting in a severe population decline. While manatees are now protected from hunting, more than 30% of manatee deaths continue to be human-related, primarily from collisions with boats, but also including entanglement in commercial fishing gear, and being crushed in canal locks and floodgates (FFWCC 2001). Manatees spend much of their time feeding and resting in shallow seagrass beds, which often results in their being struck by boats, as they cannot always dive quickly or deep enough to avoid being hit. A significant factor in the decline of the manatee population has been the loss of seagrass beds, the manatee's primary food source, due to human development impacts on coastal waters.

AQUATIC REPTILES

Four species of sea turtles are found in the waters around Cape Lookout National Seashore: the green sea turtle, Kemp's ridley sea turtle, leatherback sea turtle, and Atlantic loggerhead sea turtle. The Kemp's ridley and leatherback are listed as federally and state endangered, and the Atlantic loggerhead and green sea turtles are listed as federally and state threatened (USFWS 2003). These sea turtles are present in park waters between the spring and fall, and Atlantic loggerheads and green sea turtles nest on Atlantic side beaches of the park during the summer months. Leatherback turtles also nest on the park's beaches. In 2003, the first known nesting of a Kemp's ridley turtle at Cape Lookout was documented (NPS 2003). The shallow waters of Core and Back Sounds are important feeding areas for juvenile and adult sea turtles migrating up and down the coast. While sea turtles are active, such as during migrations or while feeding,

they must swim up to the surface to breathe every few minutes, but when they are resting, they can remain underwater for much longer periods of time.

Sea turtle populations in the western Atlantic have been adversely impacted due to alteration and loss of nesting habitat and increased mortality from boat strikes, ingestion of fishing line or hooks, and entanglement in commercial fishing gear.

The coastline from Virginia to Florida supports the second largest nesting population of loggerhead turtles in the world. The beaches of Cape Lookout provide significant nesting habitat for Atlantic loggerhead sea turtles. These turtles nest along the oceanside beaches of Shackleford Banks, South Core Banks, and North Core Banks, and in some years nesting also occurs on the soundside of Power Squadron Spit. Cape Lookout National Seashore conducts an intensive sea turtle nest monitoring program to manage these protected species. During daily patrols in the nesting season, sea turtle nests are identified, marked, and covered with steel screens to keep predators from damaging nests and consuming the eggs. Nests that are located in areas susceptible to washouts from storms and high tides are relocated to higher ground in several beach areas, each up to a mile long and which are seasonally closed to vehicles. Beach vehicle closures provide a corridor free of tire ruts which otherwise could trap turtle hatchlings on their way to the ocean, leading to mortality through desiccation or predation.

From 1990 to 2003, the number of sea turtle nests at Cape Lookout ranged from 89 to 242, with an annual average of 131 (NPS 2003a). In 2003, there were 161 sea turtle nests in the park, distributed as follows: 20 at Shackleford Banks; 78 at South Core Banks; and 63 at North Core Banks. Nearly all nesting consists of Atlantic loggerheads, although two green sea turtles are believed to have nested, and one Kemp's Ridley is known to have nested. Leatherback and Kemp's Ridley sea turtles very rarely nest in North Carolina, but both turtles are present in waters around the park. Each year, numerous sea turtles are found stranded and dead on beaches at Cape Lookout. Some of these mortalities are caused by collisions with boats, as evidenced by propeller scars and cracks on turtle shells (NPS 2003a). In 2003, there were 63 strandings of dead sea turtles and three live strandings at Cape Lookout. Atlantic loggerheads and green sea turtles comprised most of the strandings, but Kemp's Ridley and leatherbacks also stranded. Of these strandings, 23 occurred on the soundside of Cape Lookout, which demonstrates the presence of turtles in soundside waters. Strandings occur throughout the year, but are more common in May and June, and then again in early winter (Jeff Cordes, NPS-Cape Lookout National Seashore, pers. comm. 5/19/02).

The American alligator is a large reptile reaching lengths of six to twelve or more feet, and blackish in appearance, with pale crossbands on the back and vertical markings on the sides. Alligators inhabit rivers, swamps, estuaries, lakes, and marshes in the southeastern United States from North Carolina to Texas. Both adults and young feed on a variety of animals, including fish, turtles, and other aquatic organisms (NatureServe Explorer).

Formerly on the endangered species list, the American alligator has subsequently been considered fully recovered and was listed as threatened due to similarity of appearance in 1987. Although American alligator populations have responded well to protection and regulated hunting is now allowed in most states within the alligator's range, several species of crocodiles and caymans similar in appearance to the alligator are still endangered. For this reason, The U.S. Fish and Wildlife Service regulates the legal trade of alligator skins and products in order to protect endangered crocodile and cayman species with skin that is similar in appearance (USFWS n.d.). It is also a state-listed threatened species. It rarely visits the Core Banks and has been sighted once on the beach (*GMP Amendment* [NPS 2001a]).

TERRESTRIAL REPTILES

The Carolina diamondback terrapin is a state listed special concern species. It primarily inhabits coastal salt marshes and can tolerate fresh water, but rarely leaves salt or brackish water (Davidson n.d.). The Carolina diamondback terrapin is a resident of the salt marsh environment at Cape Lookout, which is generally located on the soundside of the islands (*GMP Amendment* [NPS 2001a]). Cape Lookout National Seashore staff report that this turtle is common in the marshes and soundside waters of the park (Michael Rikard, Cape Lookout National Seashore Resource Management Specialist, pers. comm. 5/19/2003).

The diamondback terrapin was formerly the target of large-scale commercial harvesting for meat. Since being granted protection throughout most of its range, terrapin populations have rebounded, but significant numbers of terrapins continue to drown in commercial fishing pound nets and eel and crab pots. The park has no monitoring data on diamondback terrapins at Cape Lookout.

The Carolina water snake, also known as the Caroline salt marsh snake, is a state listed special concern species. It is a coastal subspecies of the northern water snake and inhabits brackish water, salt marshes, and fresh water along the Outer Banks (Davidson n.d.). It is a resident of the salt marsh environment at Cape Lookout, which is generally located on the soundside of the islands (*GMP Amendment* [NPS 2001a]).

The Outer Banks kingsnake is a state listed special concern species. It is a subspecies of the eastern kingsnake and is often brownish in ground color with heavy speckling. They often feed on other snakes, though they also eat various rodents, amphibians, lizards, birds, and bird eggs (Davidson n.d.). The Outer Banks kingsnake may be found in shrub thickets behind the dunes (*GMP Amendment* [NPS 2001a]).

BIRDS

The roseate tern is both a federal and state listed endangered species. It nests on islands on sandy beaches, open bare ground or grassy areas, often with the common tern. It has attempted, with little success, to nest in salt marshes (NatureServe Explorer). It rarely visits Cape Lookout, and does not nest within the park (*GMP Amendment* [NPS 2001a]).

The American bald eagle is both a federal and state-listed threatened species. Typical habitat within the national seashore consists of areas with adequate food, perching areas, and nesting sites (USFWS fact sheet n.d.). It uses the national seashore in limited numbers for feeding and resting (*GMP Amendment* [NPS 2001a]).

The piping plover is also both a federal and state-listed threatened species. In 2003, the birds at Cape Lookout National Seashore accounted for 58% of the nesting pairs in North Carolina. Habitat is concentrated in open beaches and tidal flats, and at Cape Lookout all nesting is near both active and inactive inlets. In 2003, 14 nesting pairs were counted with 10 pairs nesting on the North Core Banks and 4 in the South Core Banks (Piping Plover Monitoring Summary Report 2003). Even though the birds at the national seashore accounted for 2/3 of the nesting pairs in North Carolina, it may be far more important as a migratory stop and wintering area than as a nesting area (Piping Plover Monitoring Summary Report 2002). Nesting typically begins in late April or early May, and chicks hatch into August (*GMP Amendment* [NPS 2001a]). Winter critical habitat is designated for the piping plover within the national seashore on the east and west tips of Shackleford Banks and the south and north ends of both South Core Banks and North Core Banks.

The peregrine falcon was recently de-listed under the *Endangered Species Act*, but is still listed as a state listed endangered species in North Carolina. Habitat is generally open areas such as tundra, moorlands, steppe, and seacoasts, especially where there are suitable nesting cliffs. When not breeding, it occurs in areas where prey concentrate, including farmlands, marshes, lakeshores, river mouths, tidal flats, dunes and beaches, broad river valleys, cities, and airports. It often nests on ledges or holes on the face of rocky cliffs or crags, but nests also can be found on river banks, tundra mounds, open bogs, large stick nests of other species, tree hollows, and man-made structures (e.g., ledges of city buildings) (Nature Serve Explorer). It uses the national seashore primarily for feeding and resting during fall migration (*GMP Amendment* [NPS 2001a]).

The gull-billed tern is a state listed threatened species. Typical habitat is along coastlines and in salt marshes, estuaries, lagoons, and plowed fields, and, less frequently, along rivers, around lakes, and in freshwater marshes. It nests in single pairs, small scattered groups, or colonies and typically joins mixed species colonies with common terns, black skimmers, least terns, royal terns, sandwich terns, and/or caspian terns (Nature Serve Explorer). At Cape Lookout, it nests in colonies on the beach among scattered low dunes (*GMP Amendment* [NPS 2001a]).

The black skimmer is a state-listed special concern species. Primary habitat for the black skimmer is coastal waters, including beaches, bays, estuaries, and sandbars, as well as tidal creeks which are used for foraging. It primarily nests on sandy beaches, small coastal islands, and dredge spoil islands, and usually nests in association with or near terns (Nature Serve Explorer). Within the national seashore, it also nests in colonies on the beach, among scattered low dunes, and on tidal flats (*GMP Amendment* [NPS 2001a]).

The brown pelican is listed as an endangered species by the U.S. Fish and Wildlife Service, except for the Atlantic Coast, Florida, and Alabama. It is a state-listed special concern species. The brown pelican feeds primarily in shallow waters within 20 miles of shoreline, rests during the day and roosts at night on sand spits and offshore sand bars, and nests on small coastal islands that provide protection from mammal predators and have sufficient elevation to prevent flooding of nests (USFWS Species Account Brown Pelican). It flies up and down the coast and feeds offshore, but does not nest in the park (*GMP Amendment* [NPS 2001a]).

The common tern is a state listed special concern species. It is found on seacoasts, estuaries, bays, lakes, rivers, and marshes. It nests on sandy, pebbly, or stony beaches, matted vegetation, marsh islands, and grassy areas, typically on isolated, sparsely vegetated islands in large lakes or along the coast (Nature Serve Explorer). It nests in areas with other terns on the national seashore (*GMP Amendment* [NPS 2001a]).

The glossy ibis is a state listed special concern species. It is found mainly in marshes, swamps, lagoons, pond margins, lakes, or flooded pastures in fresh, brackish, and salt water. It is reported mainly in freshwater habitats on the Atlantic coast of Florida and as more common in saltwater habitats in Louisiana. It usually nests with herons or other water birds on the ground in a marsh or in small trees or bushes near water (Nature Serve Explorer). It is found in marsh habitats within Cape Lookout, which are generally located on the soundside of the islands (*GMP Amendment* [NPS 2001a]).

The least tern is a state-listed special concern species. It nests near water, particularly on seacoasts, beaches, bays, estuaries, lagoons, lakes, and rivers. It rests and loafs on sandy beaches, mudflats, and salt-pond dikes. The least tern is susceptible to human disturbances, predation, flooding, and loss of habitat (Nature Serve Explorer). Within the national seashore, it also nests in colonies on the beach, among scattered low dunes, and on tidal flats (*GMP Amendment* [NPS 2001a]).

The little blue heron is a state-listed special concern species. It is found primarily in freshwater habitats in marshes, ponds, lakes, meadows, mudflats, lagoons, streams, mangrove lagoons, and other bodies of calm shallow water. It nests in trees and shrubs to about 4 meters above ground or water, often with other herons, egrets, and ibises. The primary threat to populations is disturbance and development of nesting areas, in addition to weather and shoreline variability (Nature Serve Explorer). It is found in marsh habitats within Cape Lookout, which are generally located on the soundside of the islands (*GMP Amendment* [NPS 2001a]).

The loggerhead shrike is a state-listed special concern species. Typical habitat consists of open country with scattered trees and shrubs. It nests in shrubs or small trees, and prefers shortgrass pastures for nesting (Nature Serve Explorer). It is an occasional visitor to inland areas of the national seashore (*GMP Amendment* [NPS 2001a]).

The snowy egret is a state-listed special concern species. It is found in marshes, lakes, ponds, lagoons, mangroves, and shallow coastal habitats. It often nests with other colonial water birds in trees or shrubs, and occasionally on the ground or in marsh vegetation. The main threat to the snowy egret is from loss and degradation of wetland habitats (Nature Serve Explorer). It is found in marsh habitats within Cape Lookout, which are generally located on the soundside of the islands (*GMP Amendment* [NPS 2001a]).

The tricolored heron is a state listed special concern species. It occurs in marshes, ponds, sloughs, bayous, rivers, mangrove swamps, saltwater lagoons, and islands in both salt and fresh water. It mainly nests near salt water in mangroves or buttonwood, in thickets of tidal marshes, willow thickets or rushes of freshwater marshes, large cane, and prickly pear, and on bare coastal islands in grass. It often nests with other herons/egrets (Nature Serve Explorer). It is found in marsh habitats within Cape Lookout, which are generally located on the soundside of the islands (*GMP Amendment* [NPS 2001a]).

PLANT SPECIES

The seabeach amaranth is both a federally and state-listed threatened species. It is a small annual dune plant found only on sandy beaches. It helps to build dunes by collecting wind-blown sand and adding fertilizer to the soil. At Cape Lookout it is most common near inlets. The park may temporarily close areas to off-road vehicles if seabeach amaranth is threatened, and annual monitoring provides information about the location and abundance of the plant (Cape Lookout National Seashore website). Over 2000 individuals were counted at Cape Lookout in 1994, though the population of this annual plant varies greatly from year to year due to storm influences (*GMP Amendment* [NPS 2001a]). Main areas of seabeach amaranth populations within Cape Lookout are the northern tip of North Core Banks, and the areas of Shackleford Banks and South Core Banks adjacent to Onslow Bay (Seabeach Amaranth Location Maps of 2001 & 2002).

VISITOR USE AND EXPERIENCE

Cape Lookout National Seashore is located in the central coastal area of North Carolina. The nearest sizeable cities from park headquarters on Harkers Island are Greenville, North Carolina (92 miles, population 61,000), Goldsboro, North Carolina (110 miles, population 39,000), and Wilmington, North Carolina (115 miles, population 92,000). The nearest metropolitan areas are Charlotte, North Carolina (327 miles, population 541,000), Raleigh/Durham/Chapel Hill, North Carolina (160 miles, population 1.13 million), and Washington DC (380 miles, population 5 million).

ANNUAL VISITOR USE

In a 20-year span between 1979 and 1999, visitation at Cape Lookout National Seashore rose from 27,000 to over 550,000 (table 13). Visitation first reached 100,000 in 1985, and then averaged 281,000 recreation visits annually between 1989 and 1998. In 2001, the national seashore had approximately 625,000 recreation visits. According to park staff observations, most visitors are from the North Carolina region including metropolitan areas such as Charlotte and Raleigh-Durham.

VISITOR DISTRIBUTION

Monthly visitor use is documented from 1979 through 2003, and while the national seashore is open year-round, the highest visitor use occurs between April and October. The months of June through August generally show the highest visitation (approximately 44% of visits between 1998 and 2002). December, January, and February generally have the lowest visitation with approximately 9% of annual visitation during the same years. Based on staff observations, the typical annual peak use days are the Memorial Day, 4th of July, and Labor Day weekends. This use pattern reflects the summer vacation season and is to be expected at a water-based park where nearly all recreational use is focused on the water (NPS n.d. Public Use Statistics website).

Based on ranger patrol records and park staff observations, most active recreation occurs on or in the waters surrounding Shackleford Banks and South Core Banks, with the North Core Banks generally receiving less overall visitation. The majority of visitors are day visitors.

TABLE 13: AVERAGE ANNUAL VISITATION AT CAPE LOOKOUT NATIONAL SEASHORE, 1989–2003

Year	Number of Recreation Visitors	Percentage Change from Previous Year
1989	232,644	—
1990	283,074	21.7
1991	320,161	13.1
1992	335,281	4.7
1993	294,085	-12.3
1994	257,940	-12.3
1995	348,390	35
1996	379,370	8.9
1997	374,893	-1.2
1998	357,443	-4.7
1999	553,243	54.8
2000	446,148	-19.4
2001	625,387	40
2002	610,337	-2.4
2003	704,480	15.4
Average	**387,028**	**—**

VISITOR ACTIVITIES

No roads connect the Core Banks to the mainland, or the islands with each other. The most common methods of accessing the islands are via personal motorboat and ferry. Ferries transporting vehicles travel from the mainland to the Great Island Ferry Landing and the Long Point Ferry Landing. Of the approximate 6,000 total ferry trips (including passenger-only, non-vehicle ferries) made each year throughout the seashore, approximately 2,000 occur on diesel ferries that transport vehicles to the seashore's Great Island and Long Point landings. The remaining 4,000 trips consist of passenger-only ferries to destinations throughout the park, such as Shackleford Banks. Park staff have estimated that 99% of all visitors arrive by means other than PWC. At public meetings held in October 2001, however, several participants indicated they used their PWC to travel from locations such as Atlantic and Davis to the barrier islands.

Visitors to the park participate in a variety of recreational activities, including beach recreation (swimming, etc.), fishing (surf and boat), beach driving and off-road vehicle use, motorized boating, camping, shell collecting, historical tourism, nature/eco studies (birding, horse watching), commercial fishing, harvesting of shellfish, nonmotorized boating (sailing, kayaking, canoeing), PWC use, hunting, swimming, windsurfing and waterskiing, hiking, and photography. Because PWC use may affect these and other visitor activities, they are discussed below.

Beach Recreation

Cape Lookout National Seashore has been recognized in numerous ways for its unique natural resources. Shackleford Banks has been proposed for designation as a wilderness area; 110–130 free roaming horses on Shackleford Banks are protected under the Shackleford Banks *Wild Horses Protection Act of 1998*; Cape Lookout is a unit of the Carolina-South Atlantic Biosphere Reserve; and, in 2001, Cape Lookout National Seashore was designated one of the cleanest beaches in the United States by the Clean Beaches Council's Blue Wave Campaign. In addition, American Bird Conservancy and the Nature Conservancy designated Cape Lookout National Seashore as a Globally Important Bird Area.

There are six areas within the national seashore where visitor facility development can be found: the Harkers Island area, West Shackleford Banks, the Cape Lookout area, the Great Island Concession area, the Long Point Concession area and Portsmouth Village. There are few hiking trails on the national seashore; people can backpack and hike the island shores and engage in camping, collecting shells, watching birds or horses, swimming, and fishing.

The islands, especially Shackleford Banks, have been described by the state of North Carolina as being unique and the only significant continuation of roadless and undeveloped seashore in the state. The natural sounds of the barrier island environment are a prime component of the national seashore experience, especially in remote areas of the park. A more festive beach atmosphere can be experienced along the nearby North Carolina coast at popular resort locations, but opportunities for backcountry experiences exist at Cape Lookout.

Fishing and Hunting

Spring and fall at Cape Lookout National Seashore offer some of the best fishing on the Atlantic coast (Cape Lookout National Seashore website). Anglers come to the area in large numbers for the spring and fall fish migrations (NPS 2001a). Most of the beaches and sounds are open to fishing; however, there are no fishing piers at the park.

A traditional use of the national seashore has been waterfowl hunting in the fall. In addition to federal and state regulations, park specific regulations have been established that close specific areas of the park to hunting to protect other visitors and the park's cultural and natural resources. As defined by the state, hunting season for sea ducks and most other water birds (such as ducks, mergansers, snow geese, etc.) typically begins in October or November and continues through January or March. Historically, PWC use was highest between mid-May and September (see "PWC Use and Distribution"); therefore, PWC use would be tapering off as the water and weather cools and hunting season begins.

Camping

There are no designated campgrounds in the park; however, primitive camping is allowed on Core Banks and Shackleford Banks, except near:

- the concession cabin area
- Portsmouth Village Historic District
- Cape Lookout Light Station Complex
- Cape Lookout Coast Guard Station
- areas of private estate
- Harkers Island Administrative Site
- Turtle and Bird Closure Areas
- Designated Parking Areas, and
- within 100 yards of any cabin, house or the lighthouse.

A backcountry camping permit is required for all camping on the islands. Since 1997, the national seashore had an annual average of 8,800 overnight backcountry stays (NPS n.d. Public Use Statistics website). Camping visitation is concentrated at the west end of Shackleford Banks and is dispersed along Core Banks. Vehicle and/or trailer camping is permitted only on the beach seaward of the primary dunes or in an area marked with a camping sign along Core Banks (Cape Lookout National Seashore website). Cabins are available for rental through two concessionaires (NPS 2001a). Many visitors transport off-road vehicles or vehicle campers to the island via the ferry services, and stay for periods ranging from several days to several weeks (NPS 2001a).

Wilderness Experience

Cape Lookout completed an environmental assessment in 1984 to determine wilderness suitability, resulting in a decision to propose Shackleford Banks as potential wilderness. The NPS currently manages this land as wilderness. The potential wilderness designation applied only to emergent lands, not including the soundside spoil islands. The potential wilderness area totals 2,990 acres, 16% of the national seashore's 18,400 acres of emergent land. Under this proposal, no private vehicles would be allowed on Shackleford Banks, although private boats could continue to land anywhere along the shoreline where visitors can gain access (except in areas that might be restricted due to resource damage).

A small development enclave was proposed and subsequently built at the west end of the island, which includes a dock for ferryboat use and the NPS ranger patrol and maintenance boats. Two toilet facilities were placed within the wilderness area to provide for public sanitation. In emergencies involving resource protection and human safety, the Park Service may be required to use motorized equipment on Shackleford Banks.

Shackleford Banks is the only island within the national seashore that does not permit land-based motorized vehicular use. It also contains few developments, which are limited to the ferry dock and two toilet facilities mentioned above. Visitors must access the island by boats, which beach primarily on the soundside of the island. Few motorboats use the oceanside of the island, where the sounds of surf predominate. Visitors wishing to access Lookout Bight (which is near the east end of Shackleford) typically do so via Barden Inlet rather than the island's oceanside, preferring the calmer, more direct boat route to the popular lighthouse area. Some visitors walk or surf the oceanside of Shackleford, but the majority of the island's visitors remain on the soundside where they can swim in the calmer waters. A three-mile stretch of maritime forest fronts the soundside or the island to the west, which is popular with visitors who camp. The central and eastern ends of the island contain marshlands that also front the sound. Numerous smaller islands near the island's eastern end provide sanctuaries for the national seashore's diverse species of birds.

In evaluating environmental impacts, the NPS must take into account wilderness characteristics and values, including the primeval character and influence of the wilderness; the preservation of natural conditions (including the lack of man-made noise); and assurances that there will be outstanding opportunities for solitude, that the public will be provided with a primitive and unconfined type of recreational experience, and that wilderness will be preserved and used in an unimpaired condition.

Shoreline Use

The lands within the national seashore consist of 18,400 acres of emergent land. The most popular activity undertaken by park visitors is beach recreation, which includes swimming, picnicking, surf fishing, boating, shell collecting, horse watching, and walking. Most non-fishing visitors come to the national seashore seeking a remote beach experience away from the typical beach/hotel/resort experience found along the North Carolina coast (NPS 2001a).

Several small ferry companies provide passenger service from Harkers Island to the Cape Lookout Keeper's Quarters area. In addition, passenger ferries also operate from Beaufort and Morehead City and from Ocracoke to Portsmouth Island.

Two independent concessionaires operate passenger and vehicle ferry service and overnight accommodations (cabin facilities) at Great Island on South Core Banks and at Long Point on the North Core Banks. Between 1992 and 1997, the Morris Marina concessionaire reported transporting between 10,000 and 12,000 visitors annually to the Long Point Ferry Landing. Between the same years, the Willis concessionaire reported transporting between 15,000 and 18,000 visitors annually to the Great Island Ferry pier (NPS 2001a). Most of the concession ferry passengers are overnight visitors who occupy cabins, stay in their own RV, or camp (NPS 2001a).

Recent increases in visitation may be attributable to increases in the number of companies providing ferrying services to the islands. Increases in visitation may also result in increases in the total number of daily ferry trips and visitors accommodated per trip (NPS 2003c).

Off-road vehicle use is permitted at the national seashore, and vehicle ferries are operated by concession from Atlantic and Davis, North Carolina. There are no developed roads on Cape Lookout National Seashore; however, vehicles may be driven on the open beach and on marked sand trails. Vehicles are not allowed on Shackleford Banks. The most common vehicles found at the national seashore are four-wheel drive or all-terrain vehicles. Fishermen predominantly use off-road vehicles to travel up and down the shoreline in search of good fishing spots.

Swimming is allowed throughout Cape Lookout National Seashore, although the ocean surf is rough, there are dangerous currents at the inlets and there are no designated or life guarded swim beaches.

General Watercraft Use (Motorboats, Canoes and Kayaks)

Motorboats and other watercraft have been in use at Cape Lookout National Seashore since the park was established in 1966. Because there are no roads or bridges to the national seashore islands, all access to the barrier islands is by ferry or by private boat. There are no public boat launches or boat slips within the national seashore; however, several public launches are located on the mainland near the islands. Other than for access to the islands, watercraft at Cape Lookout National Seashore are primarily used for fishing and recreational boating and to access hunting locations. The soundside sandy beaches provide the predominant access to the national seashore for private boat owners who rarely utilize ocean beaches for access.

Through Cape Lookout National Seashore patrol logs, 6,880 boats were counted in 2001, and 6,140 in 2000 (Cape Lookout National Seashore incident data). In 2001, a maximum of 523 boats were counted in one day and in 2000, 351 boats. The slowest days had zero boats in the national seashore due to inclement weather.

Nonmotorized boat activity includes canoes, kayaks, sailboats, and sailboards. The remote and barren islands offer abundant paddling opportunities, from the quiet waters of the sound to the wild surf of the open Atlantic. Shell Point off Harkers Island is a popular windsurfing destination.

PWC Use and Distribution

Although motorboats and other watercraft have been used at Cape Lookout National Seashore prior to its establishment, it is not known when PWC use first began at the national seashore. The first official counts of PWC use occurred between 2000 and 2001, when a total of 726 PWC were counted at the national seashore (Cape Lookout National Seashore incident data), representing less than one-tenth of 1% of annual visitation, and less than 1% of summer visitation.

PWC use occurred primarily on weekends between mid-May and September and averaged between 15 and 30 per weekend day in June and July. The maximum number of PWC observed during a given day was 52 at Shackleford Banks on Saturday, May 27, 2000. That same weekend 15 PWC were observed by rangers near South Core Banks, but no PWC were observed at North Core Banks.

Approximately 203 PWC were observed in 2001 over a period of 189 days. PWC use continued to occur on summer weekends from May to September; however, the peak use was less than in 2000. The maximum number of PWC observed was 21 at Shackleford Banks on Saturday, June 30th and Saturday, August 18th. Weekend use averaged between 3 and 15 PWC on summer weekends. Along South Core and North Core Banks, PWC use was as low as 1 to 2 PWC per week. From the data, it appears that fewer

counts were conducted at Shackleford Banks, the heaviest PWC use area in the park, potentially accounting for the lower annual PWC figure.

It is estimated that, in 2003, approximately 36 PWC would have accessed Shackleford Banks on a typical high-use day, 21 at the South Core Banks, and 3 at the North Core Banks. By 2013, these numbers are expected to rise to 48, 28, and 4, respectively. Details of this analysis are provided in the "Environmental Consequences" chapter.

Park staff observations suggest that most PWC users at Cape Lookout National Seashore own their PWC and are local residents or from within 200 miles in Eastern North Carolina. Although PWC use is a small percentage of park visitation, since the park's primary PWC use was concentrated near population centers, it is expected that PWC use would increase throughout the national seashore if left unregulated (determination).

PWC use can potentially occur throughout the year, but has generally been observed to occur from May through October. Activities undertaken by PWC include running up and down the shorelines, jumping wakes and waves, and general boating activities.

The U.S. Coast Guard used PWCs for enforcement activities within the national seashore from about 2000-2002, but no longer uses PWCs. Although PWCs are helpful with PWC enforcement, no enforcement agencies currently have PWCs.

PWC Use Areas

Prior to the closure to PWC in April 2002, all areas of the park were open to PWC use, including sandy sound beaches, and the shallow sound marshlands that are not easily accessible to other motorized and sailing craft. PWC could be ridden to the barrier islands from Beaufort, Morehead City, Marshallberg, Davis, Atlantic and other small coastal mainland communities. The majority of PWC use was concentrated in two national seashore areas that also receive the heaviest visitor day-use in the park: (1) on the soundside of South Core Banks at the Lighthouse (from the Lighthouse dock through Barden Inlet and Cape Lookout Bight), and (2) the eastern five miles of sandy beach on the soundside of Shackleford Banks from Wade Shores west to Beaufort Inlet. The popularity of these two places can be attributed to the excellent soundside beaches, the attraction of the Cape Lookout lighthouse, the traditional use of Shackleford Banks, their proximity to major inlets, and their close proximity to population centers of Atlantic Beach, Morehead City, and Beaufort.

PWC use of ocean waters and beaches was rare due to rough surf conditions in the ocean and the hazard of beaching PWC in the ocean surf. Some PWC use occurred along North Core Banks and the northern South Core Banks, but was infrequent because of the many marshes and lack of beaches along the islands, the large expanse of open water in Core Sound between the barrier islands and mainland North Carolina, and the low population of local communities.

The park service has no facilities specifically available for PWC users. Staff observe that PWC users generally arrive at the national seashore with one or more other boats, singly and in pairs. Although estimates of group size for PWC users were not available at Cape Lookout, the estimated group size at comparable national park units is typically 3.0 to 4.5 people per PWC (LAW, 2004).

There are no areas of the park that can only be reached by PWC. The North Carolina coast is over 300-miles long, and opportunities for PWC use exist in the immediate area, including Core Sound, Bogue Sound, Bogue Banks-Atlantic Beach-Emerald Island, and Hammocks Beach State Park. PWC can also

operate in the waters outside of the national seashore's boundaries, which extend 150 beyond the mean low water mark on the soundside. However, Cape Lookout National Seashore is one of the few locations that allow beach camping. PWC use is not permitted at Cape Hatteras National Seashore, which is directly north of Cape Lookout, and Fort Macon State Park, which is west of Shackleford Banks across the Beaufort Inlet. PWC restrictions are in place at Atlantic Beach, which is across from Morehead City and west of Fort Macon (see "Related Federal and State PWC Regulations" for more information).

VISITOR SATISFACTION

Results of the Texas A & M survey in 1993 indicated that overall, visitors expressed high satisfaction with their trip to Cape Lookout National Seashore. Over 70% of the respondents rated the trip as "excellent" or "very good" (Texas A & M). There are no recent park visitor surveys regarding PWC use in the national seashore.

VISITOR CONFLICTS AND SAFETY

VISITOR CONFLICTS

Many of the activities undertaken by visitors to Cape Lookout National Seashore are compatible. For example, swimming, fishing, and picnicking are all possible along the shoreline and produce little or no conflict between visitors. However, boating near swimmers, anglers, and nonmotorized vessels can pose a safety concern for all parties, and noise generated by PWC can also affect visitor experiences, resulting in additional conflicts.

The national seashore received over 5,000 letters concerning PWC issues during the last public comment period, including a substantial number of complaints about PWC from visitors. Complaints not associated with the PWC public comment period consisted of about 1 to 2 per year. Kayakers and canoeists complained about safety and noise issues associated with PWC.

At Cape Lookout National Seashore, visitors have complained that PWC use conflicts with swimming, kayaking, and other beach activities. A goal of the national seashore is to provide visitors with opportunities for an isolated experience typical of a barrier island. PWC use near the shoreline of Shackleford Banks and Cape Lookout makes this difficult. According to park staff, PWC use overlaps, and occasionally conflicts, with beach recreation activities, motorized boating, sailboating, and camping at Shackleford Banks; with fishing throughout the park; with kayaks and canoes at west Shackleford Banks and other quiet water areas.

The most noticeable effects of PWC use on park visitors were congestion, noise, smell, and safety. Conflicts occasionally occurred with PWC along the marshes surrounding the barrier islands (from Cape Lookout north to New Drum Inlet) and in the navigational channels. The navigational channel for boats is very close to the soundside shore of Shackelford Banks where other recreational activities also occur. One complaint noted the harassment of dolphins by a PWC.

Park staff observed that PWC operated for longer periods of time in areas of heavy visitor use at Shackleford Banks and within the Lookout Bight. These areas support other visitor activities such as boating, fishing, and camping. Visitors also travel via ferry to Cape Lookout to see the lighthouse and historic district. The greater number of PWC that have historically occurred in these areas (prior to the closure) and the heavy visitor concentrations during summer months creates a greater potential for

conflict and for disturbance from PWC noise. Prior to closing to PWC, park visitors complained about safety and noise issues.

VISITOR SAFETY

North Carolina statistics for the year 2000 show that PWC owners were involved in a disproportionate number of boating accidents. In 2000, there were 65 PWC accidents that accounted for 38% of the 173 total boating accidents that year, and 47 persons (47%) were injured in PWC accidents out of 99 total persons injured. The North Carolina Wildlife Commission estimates that there were 35,000 to 40,000 PWC of about 350,436 total boats registered in the state. Therefore, in 2000 PWC accounted for only 10% to 11% of the vessels registered in North Carolina and were involved in 38% of the boating accidents and 47% of the injuries.

Following implementation of the PWC ban at Cape Lookout, there were 42 PWC accidents in North Carolina that accounted for 30% of the 140 total boating accidents in 2003, and 35 persons (31%) were injured (requiring medical treatment) in PWC accidents out of 113 total persons injured. The North Carolina Wildlife Commission estimates that there were 39,487 PWC of 351,753 total boats registered in the state. Therefore, in 2003 PWC accounted for only 11% of the vessels registered in North Carolina and were involved in 30% of the boating accidents and 31% of the injuries, indicating that PWC still accounted for a disproportionate number of boating accidents despite a decrease from 2000. Of those PWC involved in accidents in North Carolina waters, 83% had no formal boating safety education. The majority of accidents occurred while "cruising." (North Carolina Wildlife Resources Commission 2004).

PWC use within the national seashore was governed by North Carolina PWC regulations prior to the 2002 closure. According to the data collected during the 2000 ranger patrols, 337 patrols occurred within the national seashore, during which a total of 523 PWC were noted operating within the park and 12 PWC (or approximately 2%) were observed committing some type of legal violation. Data provided by the park indicates that, during random patrols in 2001, of the 203 PWC observed in the park there were 2 PWC violations. Park staff does little or no water-based enforcement at the national seashore (see "National Seashore Management and Operations" for more information).

PWC accidents or rescues are not likely to be reported through the NPS because most PWC operate outside of the NPS jurisdiction (150 feet from mean low water). The U.S. Coast Guard has documented few rescues in the last few years. Most accidents are likely handled outside of normal, official reporting and are probably not easily extractable. In 2002, one PWC user had to be evacuated to a local hospital because of injuries due to operating in rough surf (NPS 2003c).

RELATED FEDERAL AND STATE PWC REGULATIONS

The state of North Carolina has PWC-specific regulations that are listed in the "Alternatives" chapter. There are no state-enforced education mandates for operating PWC, except for person 12-16 years old riding without an adult. Vendors support increased PWC regulations due to liability insurance issues. Many local North Carolina jurisdictions have adopted supplemental or more stringent PWC regulations. North Carolina political jurisdictions that have enacted legislation curtailing PWC operations, principally by means of distance requirements or minimum age limitations, include Atlantic Beach (which is located west of Shackleford Banks), Brunswick County, Carolina Beach, Emerald Isle, Holden Beach, Kitty Hawk, New Hanover County, Ocean Isle, Southern Shores, Sunset Beach, Topsail Beach (Bradley 1999). None of these towns and counties exists within the national seashore jurisdiction. PWC use is also

prohibited at nearby Cape Hatteras National Seashore, which lies immediately north of Cape Lookout, and at Fort Macon State Park, which is immediately west of Shackleford Banks across Beaufort Inlet.

CULTURAL RESOURCES

The environment at Cape Lookout National Seashore has deterred extensive human settlement in the area (NPS 1978). Human occupation of the Outer Banks region initially occurred over 3,000 years ago by a hunting-fishing-gathering people. The peoples of the Outer Banks are considered to be small groups of extended families, such as the situation among the living Algonkian hunters of the North. Earlier peoples may have used the area, but there is a strong likelihood that wave action or other natural processes removed any very early sites long ago (Ehrenhard 1976).

Little is known about the nomadic hunters on the islands, and specific information about the area up to the time of Colonial English occupation is lacking (Ehrenhard 1976). Shell midden sites on the soundside of Shackleford Banks and at Cape Lookout are the only remains of early human occupation. However, these sites (most of which are outside the national seashore's jurisdiction) have been reduced to almost unintelligible remains (NPS 1982).

Cape Lookout National Recreation Area has 36 recorded archeological sites. These sites are difficult to monitor and protect due to the changing landscape of the barrier islands (*Strategic Plan* [NPS 2000c]). Shell middens were found on the islands in the past, but most have been washed away by storms (NPS 1984). None of the aboriginal sites currently known to exist within the national seashore were felt to be culturally and scientifically significant enough to justify their nomination to the National Historic Register (NPS 1978).

Of the 36 recorded archeological sites, some could potentially be impacted by PWC use at Cape Lookout. The majority of the sites exist on the soundside of Shackleford Banks, primarily in the salt marshes; some are located on small, marshy islands adjacent to Shackleford. Little evidence of these sites remains due to advanced stages of erosion and other environmental factors. The sites have become damaged from overwash or are submerged at high tide, and only erosional remnants remain. Severe erosion and movement of the land mass have almost obliterated several sites. Some of the sites are covered with thick vegetation, obscuring portions of the site from view. One site has been affected by past use of the area by sheep and goats, to the extent that "little evidence of the site remains intact" (Ehrenhard 1976).

According to park staff, looting and vandalism of cultural resources is not a substantial problem.

SOCIOECONOMICS

Cape Lookout is a group of barrier islands located off the coast of North Carolina in Carteret County. The visitor's center and Shell Point on Harkers Island are the only areas of the park that are accessible by road. Cities and towns located in the area of the national seashore include Morehead City and Beaufort, both of which are located less than 25 miles from the visitor's center on Harkers Island. New Bern, a slightly larger town, is located further inland and about 60 miles from the visitor's center. Northern Carteret County is very rural, with much of the area made up by marsh and open water. The southern portion of the county is more populated and contains Beaufort and Morehead City, along with popular beach destinations such as Emerald Isle and Atlantic Beach (LAW 2004).

Retail trade is the largest sector of Carteret County's economy, followed by manufacturing, wholesale trade, accommodation and foodservices, health care and real estate rental and leasing (Census Bureau

2002). Tourism is an extremely important part of the local economy. However, PWC use at Cape Lookout comprised only a small contribution to tourism-related revenues in the regional economy. Park staff estimate that PWC users made up approximately 0.71% of total visitation. One PWC rental shop and four PWC sales/service shops are located in communities near Cape Lookout. The PWC rental shop is located in the Salter Path/Indian Beach area. Two of the identified PWC sales shops are located in Morehead City, and two are located in New Bern. Interview data was collected from these businesses during October and November of 2002 (LAW 2004).

Based on comments received from these businesses, Shackleford Banks was a popular destination for PWC use prior to the ban in 2002, but most PWC users visited other destinations in the area outside of the national seashore as well. PWC are sold year-round, with the majority of the sales in the late spring and early summer. Interview data suggest that the PWC dealerships near Cape Lookout have other sources of revenue besides PWC sales, while the service center and rental shop identified by the NPS rely mainly on PWC. Some of the PWC dealerships sold items such as motorcycles, boats (other than PWC), motor scooters, all-terrain vehicles, trailers, generators, and outboard motors. Each firm contacted implied that their business would be affected under at least one of the alternatives that allow PWC usage at Cape Lookout. One of the PWC sales shops reported a sharp decline in sales in the years following the ban and attributed a large part of this decline to the ban on PWC at the national seashore and the negative publicity surrounding the ban. Other shop owners suggested that some decline in sales or rentals may occur in future because of the ban, but the presence of alternative locations to use PWC may have mitigated the impact (LAW 2004).

In addition to the businesses contacted, the changes in PWC management could also affect lodging establishments, restaurants, gas stations, and other retail stores in the area. These establishments may be affected if changes in PWC management lead to changes in visitation to the park and surrounding area (LAW 2004).

CAPE LOOKOUT NATIONAL SEASHORE MANAGEMENT AND OPERATIONS

Currently three full-time protection rangers (including the Chief ranger) and two six-month seasonal protection rangers are funded in the park budget and potentially available for enforcing regulations throughout the 56-mile length of Cape Lookout National Seashore. However, of those funded positions, one full time and one seasonal position are currently not filled and will remain unfilled for the remainder of 2004. Currently, Cape Lookout National Seashore does little or no focused water-based enforcement. Boat patrols are usually limited to transport corridors, as rangers travel to the islands, with higher boating enforcement emphasis being placed on periods of higher visitor use, such as summer holiday weekends and regular weekends. Even on busy holiday weekends, water-based boating enforcement is usually limited to one to two hours. Most patrol time is spent on land-based patrols, using all-terrain vehicles (ATVs) on Shackleford Banks, and ATVs and four-wheel drive vehicles on South and North Core Banks.

The NPS, the U.S. Coast Guard, the North Carolina Marine Patrol, and the North Carolina Wildlife Resources Commission all have authority to conduct law enforcement and rescue operations in national seashore waters with concurrent jurisdiction. Only the NPS is authorized to enforce NPS closures and special regulations. However, because of staffing limitations, other agencies do not routinely enforce regulations at the national seashore. While boating and PWC enforcement can be performed from conventional boats and also from the beach, use of PWCs for enforcement is often helpful. Currently, no enforcement agencies have PWCs available for PWC enforcement.

ENVIRONMENTAL CONSEQUENCES

SUMMARY OF LAWS AND POLICIES

Three overarching environmental protection laws and policies guide the NPS — the *National Environmental Policy Act* (NEPA) of 1969, and its implementing regulations; the National Parks *Omnibus Management Act of 1998* (NPOMA); and the *NPS Organic Act of 1916*.

1. The *National Environmental Policy Act* is implemented through regulations of the *Council on Environmental Quality* (CEQ) (40 CFR 1500–1508). The NPS has in turn adopted procedures to comply with the act and the CEQ regulations, as found in *Director's Order #12* (NPS 2001c), and its accompanying handbook.

2. The National Parks *Omnibus Management Act of 1998* (NPOMA) (16 USC 5901 et seq.) underscores NEPA in that both are fundamental to NPS park management decisions. Both acts provide direction for articulating and connecting the ultimate resource management decision to the analysis of impacts, using appropriate technical and scientific information. Both also recognize that such data may not be readily available, and they provide options for resource impact analysis should this be the case.

   The *Omnibus Act* directs the NPS to obtain scientific and technical information for analysis. The NPS handbook for *Director's Order #12* (NPS 2001c) states that if "such information cannot be obtained due to excessive cost or technical impossibility, the proposed alternative for decision will be modified to eliminate the action causing the unknown or uncertain impact or other alternatives will be selected" (sec. 4.4).

   Section 4.5 of *Director's Order #12* (NPS 2001c) adds to this guidance by stating "when it is not possible to modify alternatives to eliminate an activity with unknown or uncertain potential impacts, and such information is essential to making a well-reasoned decision, the NPS will follow the provisions of the regulations of CEQ (40 CFR 1502.22)." In summary, the NPS must state in an environmental assessment or impact statement (1) whether such information is incomplete or unavailable; (2) the relevance of the incomplete or unavailable information to evaluating reasonably foreseeable significant adverse impacts on the human environment; (3) a summary of existing credible scientific adverse impacts that is relevant to evaluating the reasonably foreseeable significant adverse impacts; and (4) an evaluation of such impacts based on theoretical approaches or research methods generally accepted in the scientific community.

3. The *NPS Organic Act of 1916* (16 USC 1) commits the NPS to making informed decisions that perpetuate the conservation and protection of park resources unimpaired for the benefit and enjoyment of future generations.

GENERAL METHODOLOGY FOR ASSESSING IMPACTS

While much has been observed and documented about the overall effects of PWC on the environment, as well as public safety concerns, site-specific impacts under all conditions and scenarios are difficult to measure and affirm with absolute confidence. Since PWC were introduced in parks, data collected and interpreted about them and their effects on park resources relative to other uses and influences are difficult to define and quantitatively measure, despite monitoring.

Recognizing this dilemma, the interdisciplinary planning team created a process for impact assessment, based upon the directives of the *Director's Order #12* (sec. 4.5(g) [NPS 2001c]). National park system units are directed to assess the extent of impacts on park resources as defined by the context, duration, and intensity of the effect. While measurement by quantitative means is useful, it is even more crucial for the public and decision makers to understand the implications of those impacts in the short and long-term, cumulatively, and within context, based on an understanding and interpretation by resource professionals and specialists. With interpretation, one can ascertain whether a certain impact intensity to a park resource is "minor" compared to "major" and what criteria were used to base that conclusion.

To determine impacts, methodologies were identified to measure the change in park resources that would occur with the implementation of the PWC management alternatives. Thresholds were established for each impact topic to help understand the severity and magnitude of changes in resource conditions, both adverse and beneficial, of the various management alternatives.

Potential impacts are described in terms of type (Are the effects beneficial or adverse?), context (Are the effects site-specific, local, or even regional?), duration (Are the effects short-term, lasting less than one year; or long-term, lasting more than one year?), and intensity (Are the effects negligible, minor, moderate, or major?). Because definitions of intensity (negligible, minor, moderate, or major) vary by impact topic, intensity definitions are provided separately for each impact topic analyzed in this document.

Each alternative is compared to a baseline to determine the context, duration, and intensity of resource impacts. For purposes of impact analysis, the baseline is the continuation of the prohibition of PWC use in the national seashore (no-action alternative). In the absence of quantitative data, best professional judgment is used to determine impacts. In general, the thresholds used come from existing literature on PWC, federal and state standards, and consultation with subject matter experts and appropriate agencies.

In addition to establishing impact thresholds, the national seashore's resource management objectives and goals (as stated in the "Purpose of and Need for Action" chapter) are integrated into the impact analysis. In order to further define resource protection goals relative to PWC management, the park's *Strategic Plan* (NPS 2000c) is used to ascertain the "desired future condition" of resources over the long-term. The impact analysis then considers whether each management alternative contributes substantially to the park's achievement of its resource goals, or would be an obstacle. The planning team then considers potential ways to mitigate effects of PWC on park resources, and the alternatives are modified accordingly.

For the purposes of analysis, the following assumptions are used for all impact topics:

> *Short-term impacts*: Those impacts occurring from PWC use in the immediate future (per trip through a single season of use, usually one to six months).
>
> *Long-term impacts*: Those impacts occurring from PWC use over several seasons of use through the next 10 years.
>
> *Direct impacts*: Those impacts occurring from direct PWC use or influence of PWC use.
>
> *Indirect impacts*: Those impacts occurring from PWC use that indirectly alter a resource or condition.
>
> *Impact analysis area*: Specific analyses apply only to NPS-managed portions of the waters around Cape Lookout National Seashore. Each resource impact is assessed in direct relationship to those

resources affected inside the park, to the extent that the impacts can be substantially traced, linked, or connected to PWC use inside park boundaries. Each impact topic, therefore, has an impact analysis area relative to the resource being assessed, and is further defined in the impact methodology.

CUMULATIVE IMPACTS

The CEQ regulations to implement the NEPA require the assessment of cumulative impacts in the decision-making process for federal projects. A cumulative impact is defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions" (40 CFR 1508.7). Cumulative impacts are considered for all alternatives, including the no-action alternative.

Cumulative impacts were determined by combining the impacts of the alternative being considered with other past, present, and reasonably foreseeable future actions. Therefore, it was necessary to identify other ongoing or reasonably foreseeable future projects at the national seashore and, if applicable, the surrounding region, as discussed in the "Purpose of and Need for Action" chapter.

IMPAIRMENT ANALYSIS

The *NPS Management Policies 2001* (NPS 2001d) require an analysis of potential effects to determine whether or not actions would impair park resources. The fundamental purpose of the national park system, as established by the *NPS Organic Act of 1916* and reaffirmed by the *General Authorities Act*, as amended, begins with a mandate to conserve park resources and values. NPS managers must always seek ways to avoid, or to minimize to the greatest degree practicable, adversely impacting park resources and values. However, the laws do give the NPS the management discretion to allow impacts on park resources and values when necessary and appropriate to fulfill the purposes of a park, as long as the impact does not constitute impairment of the affected resources and values. Although Congress has given the NPS the management discretion to allow certain impacts within a park system unit, that discretion is limited by the statutory requirement that the agency must leave park resources and values unimpaired, unless a particular law directly and specifically provides otherwise. The prohibited impairment is an impact that, in the professional judgment of the responsible NPS manager, would harm the integrity of park resources or values. An impact to any park resource or value may constitute impairment, but an impact would be more likely to constitute an impairment to the extent that it has a major or severe adverse effect upon a resource or value whose conservation is:

- Necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park;
- Key to the natural or cultural integrity of the park; or
- Identified as a goal in the park's general management plan or other relevant NPS planning documents.

Impairment may result from NPS activities in managing the park, visitor activities, or activities undertaken by concessionaires, contractors, and others operating in the park.

The following process was used to determine whether the various PWC management alternatives had the potential to impair park resources and values:

1. The park's authorizing legislation, the *1978 General Management Plan* (NPS 1978), the *Strategic Plan* (NPS 2000c), and other relevant background were reviewed with regard to the unit's purpose and significance, resource values, and resource management goals or desired future conditions.

2. PWC management objectives specific to resource protection goals at the park were identified.

3. Thresholds were established for each resource of concern to determine the context, intensity and duration of impacts, as defined above.

4. An analysis was conducted to determine if the magnitude of impact reached the level of "impairment," as defined by *NPS Management Policies 2001* (NPS 2001d).

The impact analysis includes any findings of impairment to park resources and values for each of the management alternatives. Impairment determinations were based on analysis presented in the Environmental Consequences chapter. Because impairment findings only apply to the resources that the park, through its enabling legislation, is mandated to protect, topics such as socioeconomics, visitor use, and park management and operations are not subject to an impairment determination.

PWC AND BOATING USE TRENDS

AVAILABLE DATA

As a part of routine duties, Cape Lookout National Seashore rangers counted PWC and other boats at one or more of the four areas (Shackleford Banks, Middle Core Banks, South Core Banks, and North Core Banks) during 2000 and 2001. These are the only two years of data available for the national seashore. The counts were recorded in patrol logs and transcribed onto Incident Data forms. In 2000, PWC and boats using the national seashore were counted on 210 days during the period of January 2 through December 30. Totals of 523 PWC and 6,140 boats were counted in 2000 (Cape Lookout National Seashore 2000 Incident Data). In 2001, PWC and boats were counted on 189 days during period of January 2 through October 20. Fewer PWC (203) but more boats (6,880) were counted in 2001 than in 2000 (Cape Lookout National Seashore 2001 Incident Data).

In addition to privately-owned PWC and other outboard boats, a large number of ferries transport people and vehicles to the national seashore. Two primary types of ferries are used: diesel-powered ferries that carry both passengers and vehicles and smaller boats that carry only passengers and are powered by large outboard engines. Diesel-powered ferries operate between Atlantic on the mainland and Long Point on North Core Banks and between Davis and Great Island Ferry Landing on South Core Banks. The Atlantic-Long Point ferry operates two ferries on an estimated 820 trips per year from April through December, while the Davis-Great Island Ferry Landing vessel operates three ferries on an estimated 1,200 trips per year from March through December.

Based on conversations with rangers, it is estimated that a total of 6,000 ferry trips are made each year to the national seashore. Of these 6,000 ferry trips, approximately 2,023 trips are made by the diesel-powered vessels and the remainder ferry trips (approximately 4,000) are made by outboards. The majority of the outboard ferries go to either Shackleford Banks or to the Cape Lookout Lighthouse on the south end of South Core Banks. A limited number of outboard ferries take passengers to North Core Banks or South Core Banks.

DATA NEEDS

In order to evaluate potential impacts on water quality, estimates are needed of PWC and boats using the national seashore on a typical high-use day. In contrast, to evaluate impacts on air quality, estimates are needed of annual totals for PWC and boat use at the national seashore. These estimates are needed for 2003 and for 2013, the projected beginning and end of the evaluation. PWC and boat use estimates for 2000–2001 are the starting points for PWC and boat use in the two evaluation years. Numbers of ferry trips per year also are needed for evaluation of air quality impacts and visitor use impacts.

ESTIMATES FOR TYPICAL HIGH-USE DAY IN 2000–2001

Estimates for typical high-use days were developed for each of the four areas of the national seashore – Shackleford Banks, Middle Core Banks, South Core Banks, and North Core Banks. In order to develop conservative, yet representative, estimates, counts from the five highest use days in both 2000 and 2001 were determined from the Incident Data forms. These five highest counts of PWC and boats from each year were averaged for each area. The higher averages from the two years were used as the "typical high-use day" values. As shown in table 14, typical high-use day PWC numbers selected for use in this analysis are: 33 in Shackleford Banks, 19 in South Core Banks, and 3 in North Core Banks. High-use day numbers selected for boats are: 400 in Shackleford Banks, 270 in South Core Banks, and 19 in North Core Banks. The estimate of 400 boats in Shackleford Banks is based on informal observations by the ranger familiar with that area and is higher than the numerical average of 258 (2001 data).

ESTIMATES FOR ANNUAL TOTAL USE IN 2000–2001

An estimate of annual total use of PWC and boats at the national seashore (all four areas) in 2000–2001 was based on the higher estimate for either 2000 or 2001. Because PWC and boat counts were conducted through most seasons of the year but not on all days, total PWC and boat usage was estimated by multiplying the ranger counts by the ratio of total days in a year to the number of days when counts were conducted in both 2000 and 2001. The higher annual estimate is used for the air quality analysis. Based on these calculations and rounding to account for the uncertainty in the data, estimates for annual boat use in the national seashore was 10,600 boats in 2000 and 11,400 boats in 2001. The larger annual estimate, used as the baseline in the assessment of air quality impacts, was 11,400 boats. Similarly, the larger of the total PWC estimates was used to estimate air quality impacts. With estimates of 910 PWC in 2000 and 315 PWC in 2001, the larger estimate of 910 PWC was used as the baseline for air quality.

2003 is used as the initial assessment year for the water quality and air quality impact assessments in order to be consistent with other sections of the EA (e.g., visitor use) where 2003 is the latest year with a complete data set. Only a minor increase in numbers of personal watercraft and boats are expected for 2004 versus 2003.

FUTURE USE TRENDS AND PROJECTIONS

Projected PWC and boating use trends were estimated based on:

1. State and regional population growth trends,
2. North Carolina boat and PWC registration statistics, and
3. Park visitation trends.

TABLE 14: NUMBERS OF PWC AND BOATS ON A TYPICAL HIGH-USE DAY

Shackleford Banks						
Year	**Date**	**Day**	**No. PWCs**	**No. Boats**	**Typical High-Use Day**	
2000	May 13	Saturday	30	101	**PWCs**	**Boats**
2000	May 27	Saturday	52	121	33	400[a]
2000	June 11	Sunday	34	115		
2000	July 1	Saturday	30	220		
2000	July 2	Sunday	19	218		
		Mean (2000)[b]	**33**	155		
2001	May 26	Saturday	17	[c]		
2001	May 27	Sunday	[c]	310		
2001	June 30	Saturday	21	185		
2001	July 10	Tuesday	15	322		
2001	July 14	Saturday	12	237		
2001	August 18	Saturday	21	236		
		Mean (2001)[b]	17	**258**		
South Core Banks						
2000	May 28	Sunday	15	[c]	**PWCs**	**Boats**
2000	June 24	Saturday	17	229	19	270
2000	July 2	Sunday	28	246		
2000	August 12	Saturday	16	187		
2000	August 13	Sunday	[c]	169		
2000	September 2	Saturday	18	351		
		Mean (2000)[b]	**19**	236		
2001	May 27	Sunday	4	353		
2001	June 30	Sunday	4	223		
2001	August 4	Saturday	11	323		
2001	August 12	Sunday	4	[c]		
2001	September 2	Sunday	[c]	233		
2001	September 8	Saturday	6	220		
		Mean (2001)[b]	6	**270**		
North Core Banks						
2000	July 1	Saturday	2	[c]	**PWCs**	**Boats**
2000	July 22	Saturday	[c]	8	3	19
2000	July 23	Sunday	3	[c]		
2000	July 26	Wednesday	4	[c]		
2000	July 27	Thursday	3	[c]		
2000	July 28	Friday	3	[c]		
2000	September 29	Friday	[c]	40		
2000	October 2	Monday	[c]	20		
2000	October 14	Saturday	[c]	12		

Year	Date	Day	No. PWCs	No. Boats	Typical High-Use Day	
2000	October 22	Sunday	[c]	13		
		Mean (2000)[b]	**3**	**19**		
2001	May 27	Sunday	0	8		
2001	June 17	Monday	0	5		
2001	August 4	Saturday	0	7		
2001	August 5	Sunday	0	6		
2001	September 1	Saturday	0	5		
		Mean (2001)[b]	0	6		

Sources: Cape Lookout National Seashore 2000 and 2001 Incident Data (from patrol logs)

a. Based on Cape Lookout National Seashore ranger's informal observations.

b. Based on the mean of the five highest counts in either 2000 or 2001 (in **Bold**). For use in the water quality analysis.

c. Not one of the highest five counts in the year

Most visitation to the national seashore is from the region, so population trends were compared with national seashore recreation visits over the past decade, to determine if population growth was affecting visitation.

Park staff believes that PWC use increased over the five years prior to closure in 2002, although PWC use was still a small percentage of total boat use within the national seashore prior to the ban (approximately 5.2% in 2000–2001). As the surrounding population and tourism in the area continues to increase and more residents purchase PWC, an increase in PWC use in the national seashore area would be expected.

Boating registration statistics for North Carolina show average annual increases for the years 1995 to 2001 of 1.66% (http://www.nmma.org/facts/boatingstats). Based on estimates from http://uscgboating.org/stastics, PWC registrations in North Carolina increased an average of 7.6% annually during the four consecutive years (1998–2001) with available statistics. Between April 1990 and April 2000, North Carolina's population grew by 21.4%, or 2.64% annual growth. North Carolina population is expected to increase by 17.9% between 2000 and 2010, or 2.17% annually. The six-county region surrounding the national seashore (Beaufort, Carteret, Craven, Hyde, Jones, Onslow and Pamlico counties) grew by an annual average of 1.3% and is expected to experience an annual average of 0.76% growth between 2000 and 2010 (http://demog.state.nc.us/demog/extrends.html). National seashore recreation use increased from 294,000 visitors in 1993 to over 610,000 visitors in 2002, but the change from year to year was highly variable.

Based on population growth and PWC/boating registration information, an annual 3% growth rate in PWC use between 2000–2001 (base year) and the assessment years of 2003 and 2013 is estimated for the national seashore. This growth rate is a reasonable, conservative estimate, assuming the 0.76% to 2.17% projected change in regional and state population growth, the slowing growth in PWC use (7.6% and lower; similar to national trends), and the unstable visitation figures. Based on the average statewide boat registration statistics for North Carolina, projected non-PWC boating use at the national seashore is estimated to increase at an annual rate of 1.66% through 2013.

For the purpose of evaluating impacts on air quality in 2003 and 2013, the numbers of ferry trips per year (2,023 diesel ferry trips and 3,977 outboard ferry trips) are assumed to remain constant for 2003 and 2013 due to the highly variable recreation use of the national seashore.

CONCLUSIONS

For the purpose of evaluating water quality impacts, the estimated numbers of PWC and boats at the four areas of the national seashore on a typical high-use day in 2000–2001 (2000 is the assumed base year) and 2003 and 2013 (assessment years) are shown in table 15.

For the purpose of evaluating air quality impacts, the estimated numbers of PWC and boats at the national seashore on an annual average basis for 2000–2001 (base year) and 2003 and 2013 (assessment years) are shown in table 16.

WATER QUALITY

Most research on the effects of PWC on water quality focuses on the impacts of two-stroke engines, and it is assumed that any impacts caused by these engines also apply to two-stroke engines in PWC. Two-stroke engines (and PWC) discharge a gas-oil mixture into the water. Fuel used in PWC engines contains many hydrocarbons, including benzene, toluene, ethylbenzene, and xylene (collectively referred to as BTEX). Polycyclic aromatic hydrocarbons (PAHs) also are released from boat engines, including those in PWC. These compounds are not found appreciably in the unburned fuel mixture, but rather are products of combustion. Discharges of all these compounds — BTEX and PAHs — have potential adverse effects on aquatic life and human health if present at high enough concentrations. A common gasoline additive, methyl tertiary butyl ether (MTBE) is also released with the unburned portion of the gasoline. The PWC industry suggests that although some unburned fuel does enter the water, the fuel's gaseous state allows it to evaporate readily (Sea-Doo 2000).

TABLE 15: SUMMARY OF NUMBERS OF PWC AND BOATS ON A TYPICAL HIGH-USE DAY

Area	Year	PWC	Boats
Shackleford Banks			
	2000–2001[a]	33	400
	2003[b]	36	420
	2013	48	495
South Core Banks			
	2000–2001[a]	19	270
	2003[b]	21	284
	2013	28	334
North Core Banks			
	2000–2001[a]	3	19
	2003[b]	3	20
	2013	4	24

a. Base year from table 14.

b. Assumed 3-year difference between base year and 2003.

TABLE 16: SUMMARY OF AVERAGE ANNUAL PWC AND BOATS FOR THE CAPE LOOKOUT NATIONAL SEASHORE

Year	PWC	Boats	Ferries[a]
2000–2001	910	11,400	2,023 / 3,977
2003[b]	990	12,000	2,023 / 3,977
2013	1,300	14,100	2,023 / 3,977

a. Diesel ferry trips/outboard ferry trips.

b. Assumed 3-year difference between base year (2000) and 2003.

A typical conventional (i.e., carbureted) two-stroke PWC engine discharges as much as 30% of the unburned fuel mixture into the exhaust (CARB 1999). At common fuel consumption rates, an average two-hour ride on a PWC may discharge three gallons (11.34 liters) of fuel into the water (NPS 1999). The Bluewater Network states that PWC can discharge between three and four gallons of fuel over the same time period. However, the newer four-stroke technology can reduce these emissions to meet current regulatory standards for both water and air quality (EPA 1996a). The percentage of emissions of BTEX and MTBE compounds from four-stroke inboard or outboard motors is less than those from a two-stroke outboard engine or an existing two-stroke PWC engine.

GUIDING REGULATIONS AND POLICIES

The U.S. Environmental Protection Agency (EPA) has developed national recommended ambient water quality criteria for 158 pollutants for the protection of both aquatic life and human health (through ingestion of aquatic organisms) (EPA 2002). These criteria have been adopted as enforceable standards by most states. There are no EPA water quality criteria for the protection of aquatic life for the PWC-related contaminants (EPA 2002). For the human health criteria, however, the EPA has established criteria for benzene and several PAH compounds. There are no criteria for xylene. Although there is no federal drinking water standard for MTBE, it is on the "Contaminant Candidate List" for consideration in setting health standards; there is no information about the long-term effects that MTBE can have (EPA 2001a). In 2001, an MTBE Water Quality Criteria Work Group (MTBE-WQCWG) was established, consisting of representatives from private companies, trade associations, and the EPA. This partnership generated the toxicity data necessary for deriving ambient water qualtiy criteria for MTBE, and calculated "preliminary freshwater and marine criteria" for acute and chronic exposure of aquatic organisms (Mancini et al. 2002).

The *NPS Management Policies 2001* states that the NPS will perpetuate surface water and groundwater as integral components of park aquatic and terrestrial ecosystems (*NPS Management Policies 2001,* sec. 4.6.1 [NPS 2001d]). Furthermore, the NPS will determine the quality of park surface and groundwater resources and avoid, whenever possible, the pollution of park waters by human activities occurring within and outside of parks, by

> working with appropriate governmental bodies to obtain the highest possible standards available under the *Clean Water Act* for the protection of park waters
>
> taking all necessary actions to maintain or restore the quality of surface water and groundwater within the parks consistent with the *Clean Water Act* and all other applicable federal, state, and local laws and regulations

> entering into agreements with other agencies and governing bodies, as appropriate, to secure their cooperation in maintaining or restoring the quality of park water resources (*NPS Management Policies* 2001, sec. 4.6.3 [NPS 2001d])

Cape Lookout National Seashore does not have quantifiable water quality data documenting the effects of PWC emissions since they were introduced in the 1970s. To address water quality impacts potentially resulting from continued PWC use, water quality standards were used in the absence of park-specific data as a basic principle to guide the analysis.

Simply stated, a water quality standard defines the water quality goals of a waterbody by designating uses to be made of the water, by setting minimum criteria to protect the uses, and by preventing degradation of water quality through antidegradation provisions. The antidegradation policy is only one portion of a water quality standard. Part of this policy (40 CFR 131.12(a)(2)) strives to maintain water quality at existing levels if it is already better than the minimum criteria necessary to protect the uses. Antidegradation should not be interpreted to mean that "no degradation" can or will occur, as even in the most pristine waters, degradation may be allowed for certain pollutants as long as it is temporary and short-term in nature (Rosenlieb, NPS, WRD, pers. comm., June 2001).

Other considerations in assessing the magnitude of water quality impacts is the effect on those resources that depend on a certain quality or condition of water. Sensitive aquatic organisms, submerged aquatic vegetation, riparian areas, and wetlands are affected by changes in water quality, from direct and indirect sources.

Polycyclic aromatic hydrocarbons (PAHs) are formed by incomplete fuel combustion and are present in uncombusted petroleum. Some research has shown that certain PAHs, including some found in PWC emissions, become much more toxic to plankton and other small aquatic organisms when exposed to the ultraviolet radiation in sunlight, a process known as photoxicity (EPA 1998a; Oris et al. 1998; Landrum et al. 1987; Mekenyan et al. 1994; Arfsten et al. 1996). Conversely, some PAHs may be degraded via photodegradation or microbial degradation (Fasnacht and Blough 2002; Albers 2002). Factors controlling the amount of ultraviolet radiation penetrating water include the presence and abundance of algae, water clarity, and water color. Cape Lookout National Seashore does not have data on the phototoxicity process in park waters.

METHODOLOGY AND ASSUMPTIONS

In order to assess the magnitude of water quality impacts on Cape Lookout National Seashore's waters under the various PWC management alternatives, the following methods and assumptions were used:

1. The regulation at 40 CFR 131.12(a)(2) represents an overall goal or principle with regard to PWC use in that Cape Lookout National Seashore will strive to fully protect existing water quality so that "fishable/swimmable" uses and other existing or designated uses are maintained. Therefore, PWC use could not be authorized to the degree that it would lower this standard and affect these uses. To do so would potentially violate 40 CFR 131.10, which basically forbids the removal of an existing use because the activity was authorized knowing this level of pollution would occur.

2. State water quality standards governing the waters of Cape Lookout National Seashore were examined; where standards or water quality criteria were not available for pollutants present in PWC emissions, ecological and human health toxicity benchmarks for certain pollutants were acquired from various literature sources. The classification of Cape Lookout waters by the state

of North Carolina was defined; and the overall sources of water pollutants, both internal and external to the park's boundary, were identified in relation to the standards and classification.

3. Baseline water quality data, especially for pollutants associated with two-stroke engines (PAHs, hydrocarbons) were examined, if available.

4. Use patterns of motorized watercraft, including numbers and hours used, were based on observations by Cape Lookout National Seashore staff. The numbers and distribution of PWC on peak use days in 2003 (e.g., Memorial Day, July 4th, Labor Day) were assumed to be as follows: 36 at Shackleford Banks, 21 at South Core Banks, and 3 at North Core Banks. Motorboats, including outboard ferries, were assumed to be distributed as follows: 565 at Shackleford Banks, 380 at South Core Banks, and 20 at North Core Banks. Based on observations by park staff, it was assumed that 60% of the outboard ferries landed on Shackleford Banks and 40% landed on South Core Banks. No outboard ferries landed on North Core Banks. Because much of the PWC use at Cape Lookout involves beaching the PWC and visiting the islands on foot, an average PWC trip to the park was assumed to be only 10 minutes (alternative A) or 5 minutes (alternative B) in duration within park waters at 10% of full-throttle (flat-wake speed). Motorboat activity in park waters generally consists of traveling at slow speed, idling, and anchoring or beaching with the engine shut off, so a motorboat trip to the park was assumed to be 15 minutes in duration within park waters at 10% of full-throttle. Outboard ferries also were assumed to operate at 10% throttle for a trip length of 15 minutes. Future use trends for PWC and boating were estimated for the next 10 years for Cape Lookout National Seashore as discussed above. Cape Lookout National Seashore is assumed to have an annual PWC growth rate of 3% and an annual non-PWC vessel growth rate of 1.66%. The annual number of outboard ferry trips was assumed to be constant. A change in the national socioeconomic conditions (as well as the industry's marketing strategies) may cause these trends to vary one way or the other. The contaminant loading to water was calculated for a typical peak boating use day, assuming that peak PWC and motorboat use occurs simultaneously, and that full-throttle PWC and motorboat use discharges 11.34 liters of gasoline per hour into park waters (CARB 1998) (assume that 10% of full-throttle discharges 1.134 liters of gasoline per hour into park waters). Table 17 summarizes PWC and outboard motorboat distribution and vessel-hours at Cape Lookout.

TABLE 17: SUMMARY OF PWC AND MOTORBOAT DISTRIBUTION AND HOURS OF USE ON A TYPICAL PEAK-USE DAY

Area	Year	PWC	PWC-hrs[a]	Non PWC	Non PWC-hrs[b]
Shackleford Banks	2003	36	6	565	142
	2013	48	8	640	160
South Core Banks	2003	21	3.5	380	95
	2013	28	4.7	430	108
North Core Banks	2003	3	0.5	20	5
	2013	4	0.7	24	6

a. Equal to the number of PWC x 10 minutes (i.e., 1/6 hour).

b. Equal to the number of boats x 15 minutes (i.e., 1/4 hour).

5. Since no models were available to predict concentrations in water of selected pollutants emitted by PWC and motorboats, an approach was developed to provide a rough estimate of whether typical PWC (and motorboat) use over a particular time (e.g., a typical busy day on a holiday weekend) would result in exceedances of the identified standards, criteria, or toxicity benchmarks. The approach is described in appendix A. Results of this approach were then taken into account, along with site-specific information about water flow, currents, mixing, wind, turbidity, etc., as well as the specific fate and transport characteristics of the pollutant involved (e.g., volatility), to assess the potential for the occurrence of adverse water quality impacts.

6. In general, the approach provides the information needed to calculate emissions to the receiving waterbody from PWC (and, by estimation, from outboard motors) of MTBE and selected hydrocarbons whose concentrations in the raw gasoline fuel were available in the literature and for which ecological and/or human health toxicity benchmarks could be acquired from the literature. The selected chemicals were benzene, MTBE, and three PAHs (benzo(a)pyrene, naphthalene, and 1-methyl naphthalene). First the emissions of these pollutants to the water per PWC operational hour (based on literature values) was estimated, and then the total loading of the pollutants into the water, based on the estimated hours of use, was estimated. The next step was to estimate the volume of water it would take to dilute the calculated emission loading to the level of the water quality standard or benchmark. The volume of water (referred to as the "threshold volume of water") was then compared to the total available volume of water within the jurisdictional waters of the national seashore, and all the mechanisms that result in loss of the pollutant from the water were also qualitatively considered. In this way, an assessment could be made as to the potential for the standards or benchmarks to be exceeded, even on a short-term basis.

   Although there is no clear definition of how MTBE, BTEX, and PAHs resulting from marine engine exhaust affect human and aquatic health, the physical barrier of Cape Lookout increases retention times for pollutants and contaminants in Back and Core Sounds. As a result, exposure time, concentrations, and risks associated with these pollutants may increase over time.

   Hydrocarbons also have the potential to accumulate in the sediment and solids on which marine organisms feed. As a result of bioaccumulation, long-term adverse health effects in the mammals and humans who use marine life as a food source are possible. BTEX and MTBE compounds tend to transfer from water to air more rapidly than PAHs. PAHs, however, do not dissolve easily in water and tend to bond to PM and settle to the bottom sediments. Research has found that increased exposure to PAHs can adversely affect immune systems and has the potential to cause cancer in humans (Agency for Toxic Substances and Disease Registry [ATSDR] 1996a).

7. The principal mechanisms that result in loss of the pollutant from the water also were qualitatively considered. Many organic pollutants that are initially dissolved in the water volatilize to the atmosphere, especially if they have high vapor pressures, are lighter than water, and mixing occurs at the air/water interface. Other compounds that have low vapor pressure, low solubility, and high octanol/water partition coefficients tend to adhere to organic material and clays and eventually adsorb onto bottom sediments. By considering movements of the organics through the water column, an assessment can be made as to whether there could be an issue with standards or benchmarks being exceeded, even on a short-term basis. Cape Lookout National Seashore is a marine environment, and only limited water quality criteria or standards are available for PWC-related contaminants. Some states (e.g., New York, Washington) utilize freshwater quality criteria to assess effects on marine organisms for a variety of chemical parameters. This analysis adopted chronic freshwater ecological benchmarks for

benzo(a)pyrene, naphthalene, and benzene (Suter and Tsao, 1996) to determine potential water quality impacts; marine benchmarks were used for 1-methyl naphthalene (USFWS 2000b) and MTBE (Mancini et al. 2002) (table 18). Human health criteria for benzene and the PAH (benzo(a)pyrene) are based on the consumption of aquatic organisms (EPA 2002). No human health-based water quality criteria exist for MTBE.

8. Site-specific data on pollution from emissions was calculated for the national seashore. The threshold volume was determined by considering the PWC-hours of operation for each area and the loadings during operating hours; the ecotoxicological and human health benchmarks were obtained from literature or guidance.

9. The threshold volume of water was calculated in acre-feet (1 acre-foot =1 acre of water 1 foot deep). For example, if results showed that for benzo(a)pyrene, 55 acre-feet of water would be needed to dilute the expected emissions to the benchmark level, and the receiving body of water is a 100-acre reservoir with an average depth of 20 feet (= 2,000 acre-feet) and is well-mixed, then this would indicate little chance of a problem, especially when adding in the effects of any other processes that contribute to the loss of the benzo(a)pyrene from the water column. However, if the impact area is a 5-acre backwater area averaging 2 feet deep (10 acre-feet), then there may be at least a short-term issue, especially if there is little mixing in the area. Water volumes were determined from soundings on National Oceanic and Atmospheric Administration charts 11545 and 11550.

10. To assess cumulative impacts, non-PWC vessel emissions were added to PWC emissions to get a more complete estimation of loading to the receiving waterbody. Total emissions to water for PWC and outboard boats were estimated by calculating emissions for the year 2000 assuming that all vessels, including PWC, are carbureted two-stroke engines of 80 horsepower. Because newer fuel-injected two-stroke and four-stroke engines are being integrated into PWC and other vessels, emissions for 2003 were calculated by reducing the emissions from 2000 by 8%, in accordance with EPA's (1996b; 1997) estimate of hydrocarbon reduction.

11. To predict the cumulative effects of PWC emissions in the context of all other similar types of emissions, projections of existing use were extrapolated into the future as a percentage of overall emissions in order to gage the magnitude of potential water quality changes, with and without continued PWC use at the park, and taking into account the reduction in emissions required by the EPA (table 19) over the next 10 years.

TABLE 18. TOXICOLOGICAL BENCHMARKS USED IN CALCULATIONS

Chemical	Ecotoxicological Benchmark (μg/L)	Source	Human Health Benchmark (μg/L)	Source
Benzo(a)pyrene	0.014	Suter & Tsao 1996	0.018[a]	EPA 2002
Naphthalene	62	Suter & Tsao 1996		
1-methyl naphthalene	19[b]	USFWS 2000		
Benzene	130	Suter & Tsao 1996	51[a]	EPA 2002
MTBE	18,000	Mancini et al. 2002		

a. The human health criterion is for the consumption of aquatic organisms only.

b. Based on LC_{50} of 1,900 μg/l for Dungeness crab.

TABLE 19: ESTIMATED REDUCTIONS IN WATERCRAFT EMISSIONS

Date	Action
1999	EPA requires production line testing for 75% HC reduction in new outboards and begins to see reductions as newer models are introduced (EPA 1997).
2000	EPA requires production line testing for 75% HC reduction in new PWC and begins to see reductions as newer models are introduced (EPA 1997).
2003	Estimate of 8% reduction in HC emissions overall (EPA 1996b; date modified in EPA 1997)
2005	Estimate of 25% reduction in HC emissions overall as a result of newer models being gradually used (EPA 1996b; date modified in EPA 1997).
2006	EPA fully implements 75% HC reduction in new outboards and PWC (EPA 1996).
2013	Estimate of 55% reduction in HC emissions overall (EPA 1996b; date modified in EPA 1997).

Key dates in this chronology begin with 1999, when the EPA began to require production line testing for 75% hydrocarbon reduction in new outboard motors, and 2000, when testing for 75% hydrocarbon reduction in PWC was required. By 2006 all new PWC and outboards manufactured in the United States must have a 75% reduction in hydrocarbon emissions. In 2005 and 2012 overall reductions in hydrocarbon emissions were estimated to be approximately 25% and 50%, respectively, in PWC and outboard motors based on the EPA schedule. Therefore, for the purpose of evaluating future emissions, overall outboard and PWC emissions to waters at the national seashore in 2013 are expected to be reduced from 2000 emissions by approximately 55%.

12. No areas of North Carolina are currently designated by the EPA as non-attainment areas for pollution by carbon monoxide or ozone precursors such that they are subject to either the Wintertime Oxygenated Fuels or Reformulated Gasoline programs. TRW Petroleum Technologies, in conjunction with the American Petroleum Institute, performs an annual survey of non-reformulated gasoline, gasoline-alcohol blends, and reformulated gasoline from service stations throughout the country. Survey data for premium grade fuel (octane of 90 and higher) for the summer of 2002 in the southeast U.S. (including North Carolina), had MTBE concentrations ranging from 0% to 9.1% of the fuel mixture, with an average of 3.1% (Cheryl Dickson, TRW Petroleum Technologies, pers. comm. 4/29/2003). For this assessment, it was assumed that the concentration of MTBE in fuel used by all vessels is 3.1%. There are no plans to ban the use of MTBE in fuels in North Carolina (DOE 2003).

13. Existing information on PWC effects on water quality was reviewed and extrapolated to address area-specific issues. Threshold values were compared to estimated volumes of water within the park's jurisdiction. Table 20 contains contaminant loadings and threshold volumes at Cape Lookout for 2003 based on ecotoxicological and human health benchmarks. The loadings of pollutants for each geographic area were estimated based on typical high-use PWC and boating activity.

TABLE 20: PWC POLLUTANT LOADINGS FOR 2003 AND THRESHOLD VOLUMES FOR ECOTOXICOLOGICAL EFFECTS AND HUMAN HEALTH PROTECTION

	Loadings (mg) (6 PWC-hrs)	Threshold in acre-feet*	Loadings (mg) (3.5 PWC-hrs)	Threshold in acre-feet*	Loadings (mg) (0.5 PWC-hrs)	Threshold in acre-feet*
Ecotoxicological Effects	**Shackleford Banks**		**South Core Banks**		**North Core Banks**	
NPS jurisdictional waters (acre-feet)	4,460		6,810		3,890	
Benzo(a)pyrene (fuel and exhaust)	15	0.9	8.9	0.5	1.3	0.1
Naphthalene	23,100	0.3	13,500	0.2	1,930	<0.1
1-methyl naphthalene	36,100	1.5	21,000	0.9	3,000	0.1
Benzene	116,000	0.7	67,700	0.4	9,670	0.1
MTBE	143, 000	<0.1	83,700	<0.1	12,000	<0.1
Human Health Protection						
Benzo(a)pyrene (fuel and exhaust)	15	0.7	8.9	0.4	1.3	0.1
Benzene	116,000	1.8	67,700	1.1	9,670	0.2

*Threshold volumes below which ecotoxicological effects might occur or human health might be impacted.

IMPACT TO WATER QUALITY FROM PWC USE

Given the above methodology and assumptions, the following impact thresholds were established in order to describe the relative changes in water quality (overall, localized, short and long-term, cumulatively, adverse and beneficial), under the various PWC management alternatives, when compared to baseline conditions (no-action alternative).

Negligible: Impacts are chemical, physical, or biological effects that would not be detectable, would be well below water quality standards or criteria, and would be within historical or desired water quality conditions.

Minor: Impacts (chemical, physical, or biological effects) would be detectable but would be well below water quality standards or criteria and within historical or desired water quality conditions.

Moderate: Impacts (chemical, physical, or biological effects) would be detectable but would be at or below water quality standards or criteria; however, historical baseline or desired water quality conditions would be altered on a short-term basis.

Major: Impacts (chemical, physical, or biological effects) would be detectable and would be frequently altered from the historical baseline or desired water quality conditions; and/or chemical, physical, or biological water quality standards or criteria would be locally, slightly and singularly, exceeded on a short-term and temporary basis.

Impairment: Impacts are chemical, physical, or biological effects that would be detectable and would be substantially and frequently altered from the historical baseline or desired water quality conditions and/or water quality standards, or criteria would be exceeded several times on a short short-term and temporary basis. In addition, these adverse, major impacts on park resources and values would

> contribute to deterioration of the park's water quality and aquatic resources to the extent that the park's purpose could not be fulfilled as established in its enabling legislation;

affect resources key to the park's natural or cultural integrity or opportunities for enjoyment; or

affect the resource whose conservation is identified as a goal in the park's general management plan or other park planning documents.

Impacts of the No-Action Alternative: Continue Prohibition of PWC Use in Cape Lookout National Seashore

Analysis. Under this alternative, PWC use would continue to be prohibited from all jurisdictional waters of Cape Lookout National Seashore. There would be no loading of PWC emissions to park waters, so there would be no impacts on water quality or to aquatic biota.

Cumulative Impacts. Cumulative impacts associated with the no-action alternative would result from the cumulative activities taking place around Cape Lookout, including other motorized watercraft that use nearby waters and point and non-point sources of urban pollutants. These watercraft include recreational boats, commercial boats (ferries, fishing and cruise boats), and official units (police, U.S. Coast Guard, etc.). There would be no contribution of PWC to cumulative impacts under this alternative. Marine traffic (other than PWC use) in and around Cape Lookout constitutes a source of pollutants to the aquatic environment. Municipal discharges from nearby areas, as well as from local marinas, are also sources of hydrocarbons to surface waters, but were not included in the calculations.

Non-PWC motorized watercraft (i.e., outboards) are assumed to be distributed as follows: 565 at Shackleford Banks, 380 at South Core Banks, and 20 at North Core Banks. Each non-PWC is assumed to be operating for 15 minutes at 10% of full-throttle. Assuming a 1.6% average annual increase (except for outboard ferries), non-PWC numbers would increase by 2013 to 640 at Shackleford Banks, 430 at South Core Banks, and 24 at North Core Banks. Threshold volumes required for all motorized vessels other than PWC are shown in table 21.

In addition, a reduction in impacts on water quality associated with the emission of pollutants is expected in the long-term because motorized vessel hydrocarbon emissions are projected to decrease by 55% by 2013 (estimated based on EPA 1996b; 1997), as lower emission four-stroke and direct-injected two-stroke engines gradually come into use.

TABLE 21: THRESHOLD WATER VOLUMES NEEDED TO DILUTE POLLUTANTS FROM ALL MOTORIZED VESSELS AT CAPE LOOKOUT (EXCLUDING PWC), NO-ACTION ALTERNATIVE

	Shackleford Banks		South Core Banks		North Core Banks	
	2003	2013	2003	2013	2003	2013
NPS jurisdictional waters (acre-feet)	4,460		6,810		3,890	
Ecotoxicological Benchmarks[a]						
Benzo(a)pyrene (fuel and exhaust)	21	12	14	8.1	0.7	0.4
Naphthalene	7.1	4.1	4.8	2.8	0.3	0.2
1-methyl naphthalene	36	21	24	14	1.3	0.7
Benzene	17	10	11	6.6	0.6	0.4
MTBE	0.2	0.1	0.1	0.1	<0.1	<0.1
Human Health Benchmarks[b]						
Benzo(a)pyrene (fuel and exhaust)	16	9.4	11	6.3	0.6	0.3
Benzene	43	25	29	17	1.5	0.9

a. Threshold volumes (acre-feet) below which ecotoxicological effects might occur.

b. Threshold volumes (acre-feet) below which human health might be impacted.

As seen from the table, non-PWC outboards discharge organic pollutants to water. However, the available water volumes greatly exceed the threshold water volumes required for the protection of aquatic organisms and human health. Under the no-action alternative, water quality impacts based on ecotoxicological benchmarks would be negligible for all pollutants in the waters of Shackleford Banks, South Core Banks, and North Core Banks in 2003 and 2013. Impacts from motorized vessels based on human health benchmarks would also be negligible in all areas in 2003 and 2013.

Conclusion. Continuing the prohibition on PWC use at Cape Lookout National Seashore would result in no impacts on water quality of park waters. On a cumulative basis, other motorized vessels would continue to have negligible adverse impacts on Cape Lookout's water quality due to their discharge of organic pollutants.

Implementation of this alternative would not result in an impairment of water quality.

Impacts of Alternative A: Reinstate PWC Use under a Special NPS Regulation as Previously Managed

Analysis. Under alternative A, PWC use would be reinstated in all waters within Cape Lookout National Seashore as previously managed under the *Cape Lookout National Seashore: Superintendent's Compendium* (NPS 2003b), and all state regulatory requirements would apply. As previously mentioned, PWC distribution and use in 2003 are as follows: 36 at Shackleford Banks, 21 at South Core Banks, and 3 at North Core Banks, and each PWC is assumed to be operating for 10 minutes at 10% of full-throttle. The 10-minute time was assumed in view of the narrow jurisdictional waters of the national seashore (150 feet) and the typical use of PWC as a means to go from the mainland to the national seashore. Assuming a 3% average annual increase, PWC numbers would increase by 2013 to 48 at Shackleford Banks, 28 at South Core Banks, and 4 at North Core Banks.

In addition, a reduction in impacts on water quality associated with the emission of pollutants is expected in the long-term because PWC hydrocarbon emissions are projected to decrease by 55% by 2013 (estimated based on EPA 1996b; 1997). This reduction is a result of newer PWC models with lower emission four-stroke and direct-injected two-stroke engines gradually coming into use. The summary of threshold volumes (acre-feet) for this alternative is presented in table 22.

TABLE 22: THRESHOLD WATER VOLUMES NEEDED TO DILUTE POLLUTANTS FROM PWC AT CAPE LOOKOUT, ALTERNATIVE A

	Shackleford Banks		South Core Banks		North Core Banks	
	2003	2013	2003	2013	2003	2013
NPS jurisdictional waters (acre-feet)	4,460		6,810		3,890	
Ecotoxicological Benchmarks[a]						
Benzo(a)pyrene (fuel and exhaust)	0.9	0.6	0.5	0.3	0.1	0.1
Naphthalene	0.3	0.2	0.2	0.1	<0.1	<0.1
1-methyl naphthalene	1.5	1.0	0.9	0.6	0.1	0.1
Benzene	0.7	0.5	0.4	0.3	0.1	<0.1
MTBE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Human Health Benchmarks[b]						
Benzo(a)pyrene (fuel and exhaust)	0.7	0.4	0.4	0.3	0.1	<0.1
Benzene	1.8	1.2	1.1	0.7	0.2	0.1

a. Threshold volumes (acre-feet) below which ecotoxicological effects might occur.

b. Threshold volumes (acre-feet) below which human health might be impacted.

The results of the water quality analysis for PWC activity shows that for all discharged pollutants evaluated, the ecotoxicological threshold volumes estimated for 2003 and 2013 would be well below volumes of water available at the study areas. Threshold volumes are less than two acre-feet in each area, while available jurisdictional water volumes range from 3,890 to 6,810 acre-feet. Impacts on aquatic organisms are expected to be negligible for all pollutants evaluated.

Although the waters of Cape Lookout are not a source of drinking water, visitors to the park could be affected by an increase in pollutant loadings through ingestion of finfish and shellfish that have accumulated pollutants. However, threshold volumes for human health benchmarks of benzo(a)pyrene and benzene estimated for 2003 and 2013 also are well below volumes of water available at the study areas. Threshold volumes are two acre-feet or less, while available jurisdictional water volumes range from 3,890 to 6,810 acre-feet. Impacts on human health are, therefore, expected to be negligible for all pollutants evaluated. Mixing, flushing, and the resulting dilution of park waters by adjacent waters would further reduce pollutant concentrations. As previously mentioned, tidal currents at Beaufort and Ocracoke inlets reach speeds of up to 4 knots. Because Back and Core sounds are so shallow, the water volume more than doubles at high tide. Outgoing tides transport soluble pollutants out of park waters to the Atlantic Ocean.

Overall, water quality impacts due to PWC emissions of organic pollutants in both 2003 and 2013 would be negligible.

Cumulative Impacts. Cumulative impacts associated with alternative A would result from the cumulative activities taking place around Cape Lookout, including other motorized watercraft that use nearby waters and point and non-point sources of urban pollutants. As previously mentioned, motorized outboard watercraft are assumed to be distributed as follows: 565 at Shackleford Banks, 380 at South Core Banks, and 20 at North Core Banks. Assuming a 1.6% average annual increase (except for ferries), non-PWC numbers would increase by 2013 to 640 at Shackleford Banks, 430 at South Core Banks, and 24 at North Core Banks.

Threshold volumes calculated for all motorized watercraft are shown in table 23. For all discharged pollutants evaluated, the ecotoxicological threshold volumes estimated for 2003 and 2013 would be well below volumes of water available in park jurisdictional waters in the study areas. Threshold volumes are 38 acre-feet or less, while available jurisdictional water volumes range from 3,890 to 6,810 acre-feet. Impacts on aquatic organisms would be expected to be negligible for all pollutants evaluated.

TABLE 23: THRESHOLD WATER VOLUMES NEEDED TO DILUTE POLLUTANTS FROM ALL MOTORIZED WATERCRAFT AT CAPE LOOKOUT, ALTERNATIVE A

	Shackleford Banks		South Core Banks		North Core Banks	
	2003	2013	2003	2013	2003	2013
NPS jurisdictional waters (acre-feet)	4,460		6,810		3,890	
Ecotoxicological Benchmarks[a]						
Benzo(a)pyrene (fuel and exhaust)	22	13	15	8.4	0.8	0.5
Naphthalene	7.4	4.3	5.0	2.9	0.3	0.2
1-methyl naphthalene	38	22	25	15	1.4	0.8
Benzene	18	10	12	6.9	0.7	0.4
MTBE	0.2	0.1	0.1	0.1	<0.1	<0.1
Human Health Benchmarks[b]						
Benzo(a)pyrene (fuel and exhaust)	17	10	11	6.6	0.6	0.4
Benzene	45	26	30	18	1.7	1.0

a. Threshold volumes (acre-feet) below which ecotoxicological effects might occur.

b. Threshold volumes (acre-feet) below which human health might be impacted.

Threshold volumes for risks to human health from benzo(a)pyrene and benzene estimated for 2003 and 2013 would also be well below the jurisdictional water volumes of all areas. Threshold volumes are 45 acre-feet or less, while available jurisdictional water volumes range from 3,890 to 6,810 acre-feet. Risks to human health from benzo(a)pyrene and benzene, largely attributable to non-PWC use, are expected to be negligible for all areas in 2003 and 2013.

Conclusion. Under alternative A, water quality impacts from PWC use based on ecotoxicological and human health benchmarks would be negligible for all pollutants in all areas in both 2003 and 2013.

Cumulative water quality impacts from all motorized watercraft under alternative A based on ecotoxicological benchmarks would be negligible for all pollutants in all areas in 2003 and 2013. Cumulative impacts on human health from all motorized watercraft would be negligible in 2003 and 2013. In 2013, cumulative water quality impacts from watercraft are expected to be lower than in 2003 due to reduced emission rates.

Implementation of this alternative would not result in an impairment of water quality.

Impacts of Alternative B: Reinstate PWC Use under a Special NPS Regulation with Additional Management Prescriptions (Preferred Alternative)

Analysis. Under alternative B, PWC use would be allowed within ten designated access areas, as identified in the "Alternatives" chapter. PWC operation within these access areas would be restricted to a perpendicular approach to the shoreline at flat-wake speed. PWC operation would be prohibited in park waters outside of the access areas. All state regulatory requirements would continue to apply. Because of the requirement for a perpendicular approach to the shoreline at flat-wake speed under this alternative, each PWC trip was assumed to be of only 5 minutes duration within park jurisdictional waters at 10% of full-throttle.

The results of the water quality analysis for PWC activity (table 24) shows that for all discharged pollutants evaluated, the ecotoxicological threshold volumes estimated for 2003 and 2013 would be well below volumes of water available at the study areas. Threshold volumes are less than an acre-foot, while water volumes in the park range from 3,890 to 6,810 acre-feet. Impacts on aquatic organisms would be expected to be negligible for all pollutants evaluated.

TABLE 24: THRESHOLD WATER VOLUMES NEEDED TO DILUTE POLLUTANTS FROM PWC AT CAPE LOOKOUT, ALTERNATIVE B

	Shackleford Banks		South Core Banks		North Core Banks	
	2003	2013	2003	2013	2003	2013
NPS jurisdictional waters (acre-feet)	4,460		6,810		3,890	
Ecotoxicological Benchmarks[a]						
Benzo(a)pyrene (fuel and exhaust)	0.4	0.3	0.3	0.2	<0.1	<0.1
Naphthalene	0.2	0.1	0.1	0.1	<0.1	<0.1
1-methyl naphthalene	0.8	0.5	0.4	0.3	0.1	<0.1
Benzene	0.4	0.2	0.2	0.1	<0.1	<0.1
MTBE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Human Health Benchmarks[b]						
Benzo(a)pyrene (fuel and exhaust)	0.4	0.2	0.2	0.1	<0.1	<0.1
Benzene	0.9	0.6	0.5	0.3	0.1	0.1

a. Threshold volumes (acre-feet) below which ecotoxicological effects might occur.

b. Threshold volumes (acre-ft) below which human health might be impacted.

Threshold volumes for human health benchmarks of benzo(a)pyrene and benzene estimated for 2003 and 2013 are also less than an acre-foot, which is well below volumes of water available in the study areas. Impacts on human health would be expected to be negligible for all pollutants evaluated. Mixing, flushing, and the resulting dilution of park waters by adjacent waters would further reduce pollutant concentrations. As previously mentioned, tidal currents at Beaufort and Ocracoke inlets reach speeds of up to 4 knots. Incoming tides more than double the available water volume. Outgoing tides transport soluble pollutants out of park waters to the Atlantic Ocean.

Overall, water quality impacts due to PWC emissions of organic pollutants in both 2003 and 2013 would be negligible.

Cumulative Impacts. Cumulative impacts associated with alternative B would result from the cumulative activities taking place around Cape Lookout, including other motorized watercraft that use nearby waters and point and non-point sources of urban pollutants. As previously mentioned, motorized watercraft are assumed to be distributed as follows: 565 at Shackleford Banks, 380 at South Core Banks, and 20 at North Core Banks. Assuming a 1.6% average annual increase (except for ferries), non-PWC numbers would increase by 2013 to 640 at Shackleford Banks, 430 at South Core Banks, and 24 at North Core Banks.

Threshold volumes calculated for all motorized watercraft are shown in table 25. For all discharged pollutants evaluated, the ecotoxicological threshold volumes estimated for 2003 and 2013 would be well below volumes of water available in park jurisdictional waters in the study areas. Threshold volumes would be 37 acre-feet or less, while park jurisdictional water volumes range from 3,890 to 6,810 acre-feet. Impacts on aquatic organisms are expected to be negligible for all pollutants evaluated.

Threshold volumes for risks to human health from benzo(a)pyrene and benzene would also be well below the jurisdictional volumes in all areas in 2003 and 2013. Threshold volumes would be 44 acre-feet or less, while park jurisdictional water volumes range from 3,890 to 6,810 acre-feet. Risks to human health from benzo(a)pyrene and benzene, largely attributable to non-PWC use, would be expected to be negligible for all areas in 2003 and 2013.

TABLE 25: THRESHOLD WATER VOLUMES NEEDED TO DILUTE POLLUTANTS FROM ALL MOTORIZED WATERCRAFT AT CAPE LOOKOUT, ALTERNATIVE B

	Shackleford Banks		South Core Banks		North Core Banks	
	2002	2012	2002	2012	2002	2012
NPS jurisdictional waters (acre-ft)	4,460		6,810		3,890	
Ecotoxicological Benchmarks[a]						
Benzo(a)pyrene (fuel and exhaust)	21	12	14	8.3	0.8	0.5
Naphthalene	7.3	4.2	4.9	2.8	0.3	0.2
1-methyl naphthalene	37	21	25	14	1	0.8
Benzene	17	10	12	6.7	0.6	0.4
MTBE	0.2	0.1	0.1	0.1	<0.1	<0.1
Human Health Benchmarks[b]						
Benzo(a)pyrene (fuel and exhaust)	17	10	11	6.4	0.6	0.4
Benzene	44	26	30	17	1.6	0.9

a. Threshold volumes (ac-ft) below which ecotoxicological effects might occur.

b. Threshold volumes (ac-ft) below which human health might be impacted.

Conclusion. Under alternative B, water quality impacts from PWC use based on ecotoxicological and human health benchmarks would be negligible for all pollutants in all areas in both 2003 and 2013.

Cumulative water quality impacts from all motorized watercraft under alternative B based on ecotoxicological benchmarks would be negligible for all pollutants in all areas in both 2003 and 2013. Cumulative impacts on human health from all motorized watercraft would be negligible in 2003 and 2013. In 2013, cumulative water quality impacts from watercraft are expected to be lower than in 2003 due to reduced emission rates.

Implementation of this alternative would not result in an impairment of water quality.

AIR QUALITY

PWC emit various compounds that pollute the air. Up to one third of the fuel delivered to the typical two-stroke carbureted PWC engine is unburned and discharged; the lubricating oil is used once and is expelled as part of the exhaust; and the combustion process results in emissions of air pollutants such as VOC, NO_x, PM, and CO. PWC also emit fuel components such as PAH that are known to cause adverse health effects.

Even though PWC engine exhaust is usually routed below the waterline, a portion of the exhaust gases go into the air. These air pollutants may adversely impact park visitor and employee health as well as sensitive park resources. For example, in the presence of sunlight, VOC[4] and NO_x emissions combine to form ozone (O_3). O_3 causes respiratory problems in humans, including coughs, airway irritation, and chest pain during inhalations (EPA 1996c). O_3 is also toxic to sensitive species of vegetation. It causes visible foliar injury, decreases plant growth, and increases plant susceptibility to insects and disease (EPA 1996c). CO can affect humans as well. It interferes with the oxygen carrying capacity of blood, resulting in lack of oxygen to tissues. NO_x and PM emissions associated with PWC use can degrade visibility (EPA 2000). NO_x can also contribute to acid deposition effects on plants, water, and soil. However, because emission estimates show that NO_x from PWC are minimal (less than 5 tons per year), acid deposition effects attributable to PWC use are expected to be minimal.

GUIDING REGULATIONS AND POLICIES

Clean Air Act. The *Clean Air Act* established national ambient air quality standards (NAAQS) to protect the public health and welfare from air pollution. The act also established the prevention of significant deterioration (PSD) of air quality program to protect the air in relatively clean areas. One purpose of this program is to preserve, protect, and enhance air quality in areas of special national or regional natural, recreational, scenic, or historic value (42 USC 7401 et seq.). The program also includes a classification approach for controlling air pollution.

- Class I areas are afforded the greatest degree of air quality protection. Very little deterioration of air quality is allowed in these areas, and the unit manager has an affirmative responsibility to

4. Hydrocarbon emissions from internal combustion are characterized in various references and regulations as total hydrocarbons (THC), hydrocarbons (HC), volatile organic compounds (VOC), and reactive organic gases (ROG), as well as other terms. While there are technical differences among some of these terms, the quantitative differences are negligible for purposes of this environmental analysis. The remainder of this discussion describes all hydrocarbon emissions as HC, which is the term used in the EPA regulation for control of emissions from marine engines.

protect visibility and all other Class I area air quality related values from the adverse effects of air pollution.

- Class II areas include all national park system areas not designated as Class I, and the *Clean Air Act* allows only moderate air quality deterioration in these areas. In no case, however, may pollution concentrations violate any of the national ambient air quality standards. Cape Lookout National Seashore is designated a Class II area.

Conformity Requirements. National Park System areas that do not meet the NAAQS or whose resources are already being adversely affected by current ambient levels require a greater degree of consideration and scrutiny by NPS managers. Areas that do not meet NAAQS for any pollutant are designated as nonattainment areas. Section 176 of the *Clean Air Act* states:

> No department, agency, or instrumentality of the Federal Government shall engage in, support in any way or provide financial assistance for, license or permit, or approve, any activity which does not conform to an implementation plan [of the State]. . . . [T]he assurance of conformity to such a plan shall be an affirmative responsibility of the head of such department, agency or instrumentality.

Essentially, federal agencies must ensure that any action taken does not interfere with a state's plan to attain and maintain the NAAQS in designated nonattainment and maintenance areas. In making decisions regarding PWC use within a designated nonattainment or maintenance area, park managers should discuss their plans with the appropriate state air pollution control agency to determine the applicability of conformity requirements. Cape Lookout National Seashore is within an attainment area for all pollutants, so the conformity requirements do not apply to this unit.

Applicable PWC Emission Standards. The EPA issued the gasoline marine engine final rule in August 1996. The rule, which took effect in 1999, affects manufacturers of new outboard engines and the type of inboard engines used in PWC. The agency adopted a phased approach to reduce emissions. The current emission standards were set at levels that are achievable by existing PWC. By 2006, PWC manufacturers will be required to meet a corporate average emission standard that is equivalent to a 75% reduction in HC emissions. (The corporate average standard allows manufacturers to build some engines to emission levels lower than the standard and some engines to emission levels higher than the standard, and to employ a mix of technology types, as long as the overall corporate average is at or below the standard.) Because the actual reduction in emissions depends on the sale of lower-emitting PWC, based on EPA data (EPA 1996b, 1997), it was estimated that a 25% emission reduction would be achieved by 2005 and a 55% reduction by 2013. In July 2002, the EPA proposed new evaporative emissions standards for gasoline-fueled boats and PWC. These proposed standards would require most new boats produced in 2008 or later to be equipped with low-emission fuel tanks or other evaporative emission controls.

NPS Organic Act and Management Policies. The *NPS Organic Act of 1916* (16 USC 1, et seq.) and the *NPS Management Policies 2001* (NPS 2001d) guide the protection of park and wilderness areas. The general mandates of the *NPS Organic Act of 1916* state that the NPS will:

> promote and regulate the use of . . . national parks . . . by such means and measures as conform to the fundamental purpose of the said parks, . . . which purpose is to conserve the scenery and the natural and historic objects and the wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations (16 USC 1).

Under its management policies, the NPS will:

> seek to perpetuate the best possible air quality in parks to (1) preserve natural resources and systems; (2) preserve cultural resources; and (3) sustain visitor enjoyment, human health, and scenic vistas (sec. 4.7.1).

The *NPS Management Policies 2001* [NPS 2001d] further state that the NPS will assume an aggressive role in promoting and pursuing measures to protect air quality related values from the adverse impacts of air pollution. In cases of doubt as to the impacts of existing or potential air pollution on park resources, the NPS "will err on the side of protecting air quality and related values for future generations."

The *NPS Organic Act of 1916* and the *NPS Management Policies 2001* [NPS 2001d] apply equally to all areas of the national park system, regardless of *Clean Air Act* designations. Therefore, the NPS will protect resources at both Class I and Class II designated units. Furthermore, the *NPS Organic Act of 1916* and *NPS Management Policies 2001* [NPS 2001d] provide additional protection beyond that afforded by the *Clean Air Act's* NAAQS alone because the NPS has documented that specific park air quality related values can be adversely affected at levels below the national standards or by pollutants for which no standard exists.

METHODOLOGY AND ASSUMPTIONS

In order to assess the level of PWC air quality impacts resulting from a given management alternative, the following methods and assumptions were used:

1. The national ambient air quality standards and state/local air quality standards as presented in the "Affected Environment" chapter were examined for each pollutant.

2. Air quality designations for the surrounding area were determined. Cape Lookout National Seashore is in an attainment area for each pollutant.

3. There are no monitoring stations near the national seashore that provide representative ambient data. Review of monitoring data for inland eastern North Carolina, and the absence of monitors in the coastal area implies that concentrations of the criteria pollutants in the Cape Lookout National Seashore area are well below standards (NCDAQ 2003a).

4. Typical use patterns of motorized watercraft were identified as outlined in the "PWC and Boating Use Trends" section.

5. The rated horsepower, average engine load, and other relevant parameters for each watercraft type were taken from default assumptions in the EPA NONROAD2004 model. This model is used to calculate emissions of criteria pollutants from the operation of nonroad spark-ignition type engines, including PWC. The model allows assumptions to be made regarding the mix of engine types that will be phased in as new engine standards come into effect, and increasing numbers of PWC will be of the cleaner-burning four-stroke type.

6. Hydrocarbon emissions from internal combustion are characterized in various references and regulations as total hydrocarbons (THC), hydrocarbons (HC), VOC, and reactive organic gases (ROG), as well as other terms. While there are technical differences among some of these terms, the quantitative differences are negligible for purposes of this environmental analysis.

The remainder of this discussion describes all hydrocarbon emissions as HC, which is the term used in the EPA regulation for control of emissions from marine engines.

7. PAH are released during the combustion of fuel, though some PAH are also found in unburned gasoline. Kado et al. 2000 indicated that changing from two-stroke carbureted engines to two-stroke direct-injection engines may result in increases of airborne particulate-associated PAH. The same study indicated that four-stroke engines have considerably less PAH emissions than two-stroke engines.[5] A subsequent study of airborne emissions indicated a potential health risk from toxic pollutants in areas of high concentration of exhaust from many engines, such as in an engine maintenance shop (Kado 2001).

8. Any reductions in emissions resulting from implementing control strategies were taken into account, as were changes in emissions resulting from increased or decreased usage.

9. There are have been no studies on ozone injury to sensitive plants at the national seashore; however, park staff have not observed any ozone damage to vegetation.

10. A calculation referred to as SUM06 (ppm-hours) was used for assessing regional ozone exposure levels. These data are collected from rural and urban monitoring sites. The highest three-month, five-year average commonly used for the area was determined by reviewing ambient air quality data (available from the NPS Air Resources Division).

11. Visibility impairment was determined from local monitoring data or from qualitative evidence such as personal observations and photographs.

12. The air quality impacts of the various alternatives were assessed by considering the existing air quality levels and the air quality related values present, and by using the estimated emissions and any applicable, EPA-approved air quality models. Estimated reductions in HC emissions as a result of the introduction of cleaner engines would be the same as those described for water quality.

13. For cumulative impacts, the assessment was completed quantitatively with respect to anticipated use of the area by other recreational watercraft and ferries based on emission factors and assumption in the EPA NONROAD2004 model. Types of craft assessed for quantitative cumulative impacts included outboard and inboard spark-ignition type engines and PWC. Other sources of air pollutants in the area also were qualitatively considered in the cumulative analysis through a review of the state implementation plan, county records, and the use of best professional judgment.

14. Annualized pollutant emissions were calculated for 2003 and 2013 using the methodology described in the "Water Quality" section. Estimates of watercraft use were based on park staff observations and statistics from various sources including the *1978 General Management Plan* (NPS 1978), North Carolina state population projections, and National Marine Manufacturers Association boating registration statistics.

15. Cumulative impacts were analyzed quantitatively, with consideration given to boat and PWC air emissions. Although Cape Lookout National Seashore does maintain vehicular access to some of the park that is open to cars, trucks, and recreational vehicles, emissions from these

5. It is noted that only one engine of each type, two-stroke carbureted, two-stroke direct injection, and four-stroke, was tested.

vehicles were not assessed quantitatively, however they were included in the cumulative analysis. Regional scale impacts resulting from development outside of the park units was not considered quantitatively because the localized effects of individual projects will be indistinguishable from ambient background impacts due to the transport distance from the source to the park units.

PWC impact thresholds for air quality are dependent on the type of pollutants produced, the background air quality, and the pollution-sensitive resources (air quality related values) present. Air quality related values include "visibility and those scenic, cultural, biological, and recreation resources of an area that are affected by air quality" (43 FR 15016). Impact thresholds may be qualitative (e.g., photos of degraded visibility) or quantitative (e.g., based on impacts on air quality related values or federal air quality standards, or emissions based), depending on what type of information is appropriate or available.

Because the EPA has established standards that are regulated by states to protect human health and the environment, two categories for potential airborne pollution impacts from PWC are analyzed: impacts on human health resources and impacts on air quality related values in the impact analysis area. Thresholds for each impact category (negligible, minor, moderate, and major) are discussed for each impact topic.

IMPACT ANALYSIS AREA

The impact analysis area includes the immediate location of PWC and boat use and the surrounding national seashore area where air pollutants may accumulate.

IMPACT TO HUMAN HEALTH FROM AIRBORNE POLLUTANTS RELATED TO PWC USE

The following impact thresholds for an attainment area have been defined for analyzing impacts on human health from airborne pollutants — CO, PM_{10}, HC, and NO_x. Sulfur oxides (SO_x) are not included because they are emitted by PWC in very small quantities.

	Activity Analyzed		Current Air Quality
Negligible:	Emissions would be less than 50 tons/year for each pollutant.	and	The first highest 3-year maximum for each pollutant is less than NAAQS.
Minor:	Emissions would be less than 100 tons/year for each pollutant.	and	The first highest 3-year maximum for each pollutant is less than NAAQS.
Moderate:	Emissions would be greater than or equal to 100 tons/year for any pollutant.	or	The first highest 3-year maximum for each pollutant is greater than NAAQS.
Major:	Emissions levels would be greater than or equal to 250 tons/year for any pollutant.	and	The first highest 3-year maximum for each pollutant is greater than NAAQS.

Impairment — Impacts would:

- Have a major adverse effect on national seashore resources and values; and
- Contribute to deterioration of the national seashore's air quality to the extent the national seashore's purpose could not be fulfilled as established in its authorizing legislation; or

- Affect resources key to the national seashore's natural or cultural integrity or opportunities for enjoyment; or

- Affect the resource whose conservation is identified as a goal in the national seashore's general management plan or other planning documents.

Both HC and NO_x are ozone precursors in the presence of sunlight and are evaluated separately in lieu of ozone, which is formed as a secondary pollutant. (Note that in attainment areas the *Clean Air Act* does not require that NO_x be counted as an ozone precursor.)

Impacts of the No-Action Alternative: Continue Prohibition of PWC Use in Cape Lookout National Seashore

Analysis. PWC use would not be reinstated in the national seashore under the no-action alternative. There would be no contribution of CO, PM_{10}, HC, and NO_x emissions from PWC and no air quality impacts from PWC use within the national seashore boundaries.

Cumulative Impacts. Regional emissions of all marine vehicles and boating activities under the no-action alternative are assessed quantitatively in table 26. Under the no-action alternative, there would be no contribution from PWC within the national seashore to overall cumulative emissions, but non-PWC motorized boats would continue to emit pollutants. PWC use would continue to occur outside of national seashore boundaries.

As described in the "Air Quality Methodology" section, boats accounted for approximately 92% of the annual motorized watercraft activity in the national seashore in 2003. Based on data provided in the "PWC and Boating Use Trends" section, non-PWC annual boat use was estimated at 12,000 vessels in 2003, increasing at approximately 1.7% annually to 14,100 non-PWC boats in 2013. Additionally, a total of 6,000 ferry trips were assumed to occur in both 2003 and 2013. Ferry activity is included in the motorized boat portion of the emission estimates. Of the 6,000 total ferry trips, 2,023 were conducted using large diesel ferries, while the remaining 3,977 were conducted using gasoline powered outboard engines.

The impacts on human health from airborne pollutants from non-PWC boat use are presented in table 26. Adverse impacts related to use in 2003 would be negligible for CO, PM_{10}, HC, and NO_x. In 2013, human-health-related air quality impacts reflect the predicted 1.7% annual increase in non-PWC activity and a forecasted reduction in engine HC emission rates compared to 2003. Impacts on human health from PWC air pollutants in 2013 would remain negligible for CO, PM_{10}, HC, and NO_x. NO_x emission levels would increase due to increased boating activity. Even with the 1.7% increase in boating activity, HC, and CO emissions in 2013 would be less than in 2003 because of the continuing introduction of cleaner engines. Overall impact to regional ozone levels in 2013 would be reduced.

TABLE 26: NON-PWC MOTORIZED BOAT EMISSIONS AND HUMAN HEALTH IMPACT LEVELS AT CAPE LOOKOUT NATIONAL SEASHORE, NO-ACTION ALTERNATIVE

	CO		PM_{10}		HC		NO_x	
	2003	2013	2003	2013	2003	2013	2003	2013
Annual Emissions (tons/year)	24.2	23.0	0.1	0.1	1.8	1.5	1.8	1.9
Impact Level	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible

Conclusion. Continuing the ban on PWC at Cape Lookout National Seashore would have no impacts on human health for PWC related CO, PM_{10}, HC, and NO_x emissions for both 2003 and 2013.

Cumulative adverse impacts on human health from airborne pollutants in both 2003 and 2013 would be negligible for CO, HC, PM_{10} and NO_x. Slightly increased NO_x emissions in 2013 would result from increased boating activity and consideration of the conversion to new technology engines. However, with improved emission controls, future emissions of CO and HC would continue to decline. The reductions in HC emissions from conversion to cleaner engines would contribute to a reduced impact to regional ozone levels in 2013. Contributions from land-based sources of air emissions would likely be negligible. The risk from PAH also would be negligible in 2003 and 2013.

Implementation of this alternative would not result in an impairment of air quality.

Impacts of Alternative A: Reinstate PWC Use under a Special NPS Regulation as Previously Managed

Analysis. Under alternative A, PWC use at the national seashore would be reinstated in all waters within the Cape Lookout National Seashore and managed under the management strategies that were in place before the park was closed to PWC use in April of 2002. All state regulatory requirements would apply.

The impacts on human health from airborne pollutants from PWC use are presented in table 27. Adverse impacts related to PWC use in 2003 would be negligible for CO, PM_{10}, HC, and NO_x. As a result of cleaner engines and increased PWC users, impacts on human health from PWC air pollutants in 2013 would remain negligible for CO, PM_{10}, HC, and NO_x, even though the number of PWC would increase from 990 in 2003 to 1,300 in 2013.

As carbureted two-stroke engines are converted to cleaner engines, some increase in PAH emissions could occur related to two-stroke direct-injection engines (Kado et al. 2000). However, these increases would be offset by the reduction in PAH that would occur with conversion to four-stroke engines. HC emissions due to PWC use are shown in table 27. Because the no-action alternative excludes PWC use, the total emissions listed in these two tables represent the total projected increase in PWC emissions. The human health risk from PAH would be negligible in 2003 and 2013.

Cumulative Impacts. Under alternative A, PWC use would contribute to cumulative impacts related to the pollutants emitted by all motorized vessels.

The combined emissions from PWC and other boats are provided in table 28. PWC emissions would contribute to cumulative impacts on air quality under alternative A. Overall, cumulative adverse impacts on human health from airborne pollutants in 2003 would be negligible for CO, PM_{10}, NO_x, and HC based on the quantities of emissions and maximum pollutant levels that are less than the NAAQS. Overall cumulative adverse impacts on human health from air pollutants in 2013 would remain negligible for CO, $PM_{10,}$ NO_x, and HC.

TABLE 27: PWC EMISSIONS AND HUMAN HEALTH IMPACT LEVELS AT CAPE LOOKOUT NATIONAL SEASHORE, ALTERNATIVE A

	CO		PM_{10}		HC		NO_x	
	2003	2013	2003	2013	2003	2013	2003	2013
Annual Emissions (tons/year)	0.5	0.7	< 0.01	< 0.01	0.1	0.1	0.01	0.01
Impact Level	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible

TABLE 28: PWC AND MOTORIZED BOAT EMISSIONS AND HUMAN HEALTH IMPACT LEVELS AT CAPE LOOKOUT NATIONAL SEASHORE, ALTERNATIVE A

	CO		PM_{10}		HC		NO_x	
	2003	2013	2003	2013	2003	2013	2003	2013
Annual Emissions (tons/year)	22.7	23.7	0.1	0.1	1.9	1.6	1.8	1.9
Impact Level	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible

Conclusion. Alternative A would result in negligible adverse impacts on human health related to the PWC airborne pollutants CO, PM_{10}, HC, and NO_x for the year 2003. The risk from PAH would also be negligible. In 2013 there would be increases in CO, PM_{10}, HC, and NO_x emissions, and the impact level for these pollutants would remain negligible, the same as in 2003. The total increase in emissions resulting from alternative A for all pollutants is shown in table 28.

Cumulative emission levels from all boating would be negligible for CO, PM_{10}, NO_x, and HC in 2003 and 2013.

Overall, alternative A would have negligible adverse impacts on existing air quality conditions, with future reductions in PM_{10} and HC emissions due to improved emission controls. Overall, PWC emissions of HC are estimated to be less than 1% of the cumulative boating emissions in 2003 and 2013. Contributions from land-based sources of air emissions would likely be negligible.

Implementation of this alternative would not result in an impairment of air quality.

Impacts of Alternative B: Reinstate PWC Use under a Special NPS Regulation with Additional Management Prescriptions (Preferred Alternative)

Analysis. Under this alternative, special use areas would be identified where PWC could access Shackleford Banks, South Core Banks, and North Core Banks. PWC access could only access the beach in these areas and approach only perpendicular to the beach at flat-wake speeds. PWC use and access would be prohibited in all other areas of the national seashore. Safety and operating restrictions would be dictated by the North Carolina PWC regulations outlined under alternative A and additional NPS operating restrictions.

Human-health air quality impacts from alternative B would be similar to those described for alternative A for 2003 and 2013 and would be negligible for CO, PM_{10}, HC, and NO_x. The human health risk from PAH would also be negligible in 2003 and 2013. The additional restrictions would not change the type of PWC in use, nor increase or decrease the number of PWC forecasted. The assumed daily duration of use would decrease from 10 minutes under alternative A to 5 minutes under alternative B for both 2003 and 2013. Therefore, impacts would be negligible and at even lower levels than under alternative A.

Cumulative Impacts. Under alternative B, cumulative impacts from all boating use in the national seashore would not change from alternative A. Adverse impacts on human health from air pollutants in 2003 would be negligible for CO, PM_{10}, NO_x, and HC. In 2013, levels would remain negligible for CO, PM_{10}, NO_x, and HC.

Conclusion. Because no reduction in PWC use is expected, alternative B would result in negligible air quality impacts on human health from PWC emissions, similar to alternative A. The additional management prescriptions would slightly reduce PWC emissions as compared with alternative A.

Negligible adverse impacts from PWC emissions for CO, PM_{10}, HC, and NO_x would occur in 2003 and 2013. The risk from PAH would also be negligible in 2003 and 2013.

Cumulative adverse impacts from PWC and other boating emissions at the national seashore would be the same as for alternative A. Adverse impacts on human health from air pollutants in 2003 would be negligible for CO, PM_{10}, NO_x, and HC. In 2013, levels would remain negligible for CO, PM_{10}, NO_x, and HC. Regional ozone emissions would improve due to a reduction in HC emissions.

This alternative would have negligible adverse impacts on human health air quality conditions, with future reductions in CO and HC emissions due to improved emission controls. The PWC contribution to emissions of HC is estimated to be less than 5% of the cumulative boating emissions in 2003 and 2013. All impacts would be long-term.

Implementation of this alternative would not result in an impairment of air quality.

IMPACT TO AIR QUALITY RELATED VALUES FROM PWC POLLUTANTS

Impacts on environmental resources and values include visibility and biological resources (specifically ozone effects on plants) that may be affected by airborne pollutants emitted from PWC and other sources. These pollutants include O_3, NO_x, HC and PM. $PM_{2.5}$ and NO_x emissions are evaluated for visibility impairment. HC and NO_x are precursors to the formation of ozone and are evaluated in lieu of ozone emissions.

To assess the impact of ozone on plants, the 5-year ozone index value, called SUM06, was calculated. The Air Resources Division of the NPS, based on local monitoring site data, developed SUM06 values used in this analysis.

To assess a level of impact on air quality related values from airborne pollutants, both the emissions of each pollutant related to motorized watercraft activity and the background air quality must be evaluated and then considered according to the thresholds defined below.

	Activity Analyzed		**Current Air Quality**
Negligible:	Emissions would be less than 50 tons/year for each pollutant.	**and**	There are no perceptible visibility impacts (photos or anecdotal evidence). **and** There is no observed ozone injury on plants. **and** SUM06 ozone is less than 12 ppm-hr.
Minor:	Emissions would be less than 100 tons/year for each pollutant.	**and**	SUM06 ozone is less than 15 ppm-hr.
Moderate:	Emissions would be greater than 100 tons/year for any pollutant. **or** Visibility impacts from cumulative PWC emissions would be likely (based on past visual observations).	**or**	Ozone injury symptoms are identifiable on plants. **and** SUM06 ozone is less than 25 ppm-hr.

Major:	Emissions would be equal to or greater than 250 tons/year for any pollutant. **or** Visibility impacts from cumulative PWC emissions would be likely (based on modeling or monitoring).	**and**	Ozone injury symptoms are identifiable on plants. **or** SUM06 ozone is greater than 25 ppm-hr.

Impairment: Air quality related values in the park would be adversely affected. In addition, impacts would:

- Have a major adverse effect on national seashore resources and values; and
- Contribute to deterioration of the national seashore's air quality to the extent that the national seashore's purpose could not be fulfilled as established in its authorizing legislation; or
- Affect resources key to the national seashore's natural or cultural integrity or opportunities for enjoyment; or
- Affect the resource whose conservation is identified as a goal in the national seashore's general management plan or other planning documents.

According to data compiled by the NPS, the SUM06 ozone index in the Cape Lookout National Seashore area is 0–8 ppm-hr.

Impacts of the No-Action Alternative: Continue Prohibition of PWC Use in Cape Lookout National Seashore

Analysis. Under the no-action alternative, PWC use within Cape Lookout National Seashore would not be reinstated; therefore, there would be no impacts on air quality related values from PWC.

Cumulative Impacts. While PWC use would no longer be allowed within the national seashore, other motorized watercraft would operate at the use levels described in the "PWC and Boating Use Trends" section, and the area would continue to be influenced by other sources of $PM_{2.5}$ and ozone. The cumulative impact analysis includes non-PWC motorized watercraft use, taking into consideration regional use trends as well as current and future emission levels.

Cumulative impacts on air quality related values for the national seashore are shown in table 29. Emissions of HC, NO_x and $PM_{2.5}$ would be less than 50 tons per year each for 2003 and 2013. The SUM06 ozone data show ozone in the region to be in the range of 0 to 8 ppm-hours, which indicates a negligible adverse impact. There are no documented ozone effects in the park and no perceptible visibility impacts from boat activity. Therefore, it is presumed that the HC contribution to ozone-related air quality values would be minor. Predicted year 2013 regional SUM06 ozone levels would be in the same range as year 2003. Therefore, the cumulative adverse impact to air quality related values in 2013 would remain negligible.

TABLE 29: AIR QUALITY RELATED IMPACTS FROM MOTORIZED BOAT EMISSIONS AT CAPE LOOKOUT NATIONAL SEASHORE, NO-ACTION ALTERNATIVE

Emissions (tons/year)						Visibility Observations and Forecast		Impact Level	
HC		NO_x		$PM_{2.5}$					
2003	2013	2003	2013	2003	2013	2003	2013	2003	2013
1.8	1.5	1.6	1.9	0.1	0.1	No perceptible visibility impacts	No perceptible visibility impacts	Negligible	Negligible
Local Ozone Effects						SUM06 Index Value			
Ozone injury to plants (injury symptoms and monitoring data)		2003		2013					
		No park specific effects documented		No park specific effects anticipated		0 to 8 ppm-hours	0 to 8 ppm-hours <rural monitoring> assumed to be no greater than in 2003		

Source for SUM06 values: NPS Air Quality Division year 2000 monitoring data

Conclusion. Under the no-action alternative, PWC would not contribute emissions at the national seashore and there would be no impacts on air quality related values from PWC in both 2003 and 2013. Cumulatively, there would be negligible long-term adverse impacts on air quality related values from all watercraft in 2003 and 2013. These conclusions are based on regional SUM06 values, the lack of existing or anticipated local ozone or visibility effects, and the calculated pollutant emission levels.

Implementation of this alternative would not result in an impairment of air quality related values.

Impacts of Alternative A: Reinstate PWC Use under a Special NPS Regulation as Previously Managed

Analysis. PWC use in Cape Lookout National Seashore would be reinstated according to management strategies in place prior to closure. There would be no locational restrictions or changes in speed limits from those previously enforced.

As outlined in the "PWC and Boating Use Trends" section, annual use was estimated to be 990 PWC in the national seashore in 2003, increasing at approximately 3% annually to 1,300 PWC in 2013. Table 30 presents the annual PWC emissions, SUM06 data, and qualitative assessment of visibility and ozone-related effects for 2003 and 2013 under this alternative. Emissions of each pollutant would be less than 50 tons per year in both 2003 and 2013. The SUM06 ozone data show ozone in the region to be in the range of 0 to 8 ppm-hrs, which indicates a negligible adverse impact; this evaluation reflects emissions from all local and regional sources of which PWC emissions are a very small component. Therefore, the adverse impact of PWC operation on air quality related values would be classified as negligible.

Cumulative Impacts. The cumulative impact analysis includes PWC and other motorized watercraft use, taking into consideration regional use trends as well as current and future emission levels.

HC, NO_x and $PM_{2.5}$ emissions would be less than 50 tons per year in 2003 and 2013. As described above, SUM06 ozone values for the region are in the range of 0 to 8 ppm-hours. It is presumed that the HC contribution to ozone-related air quality values would be negligible. In 2013, NO_x emissions would slightly increase but remain well below 50 tons per year, and there would be a reduction in HC emissions, resulting in improved ozone levels. Predicted year 2013 regional SUM06 ozone levels would be in the same range as year 2003. The cumulative adverse impacts from all motorized vessel use to air quality related values of the national seashore in 2013 would continue to be negligible (table 31).

TABLE 30: AIR QUALITY RELATED IMPACTS FROM PWC EMISSIONS AT CAPE LOOKOUT NATIONAL SEASHORE, ALTERNATIVE A

Emissions (tons/year)						Visibility Observations and Forecast		Impact Level	
HC		NO_x		$PM_{2.5}$					
2003	2013	2003	2013	2003	2013	2003	2013	2003	2013
0.1	0.1	0.01	0.01	< 0.01	< 0.01	No perceptible visibility impacts	No perceptible visibility impacts	Negligible	Negligible
Local Ozone Effects						SUM06 Index Value			
Ozone injury to plants (injury symptoms and monitoring data)		2003		2013					
		No park specific effects documented		No park specific effects anticipated		0 to 8 ppm-hours	0 to 8 ppm-hours <rural monitoring> assumed to be no greater than in 2003		

Source for SUM06 values: NPS Air Quality Division year 2000 monitoring data

TABLE 31: AIR QUALITY RELATED VALUES IMPACTS FROM PWC AND MOTORIZED BOAT EMISSIONS AT CAPE LOOKOUT NATIONAL SEASHORE, ALTERNATIVE A

Emissions (tons/year)						Visibility Observations and Forecast		Impact Level	
HC		NO_x		$PM_{2.5}$					
2003	2013	2003	2013	2003	2013	2003	2013	2003	2013
1.9	1.6	1.8	1.9	0.1	0.1	No perceptible visibility impacts	No perceptible visibility impacts	Negligible	Negligible
Local Ozone Effects						SUM06 Index Value			
Ozone injury to plants (injury symptoms and monitoring data)		2003		2013					
		No park specific effects documented		No park specific effects anticipated		21 to 25 ppm-hours	21 to 25 ppm-hours <rural monitoring> assumed to be no greater than in 2003		

Source for SUM06 values: NPS Air Quality Division year 2000 monitoring data.

Conclusion. Negligible adverse impacts on air quality related values from PWC use would occur in both 2003 and 2013. Emissions of each pollutant would be substantially less than 50 tons per year in both 2003 and 2013. Compared to the no-action alternative, projected emission increases are shown in table 31. Negligible adverse impacts from cumulative emissions from motorized boats and PWC would occur in both 2003 and 2013. These conclusions are based on pollutant emissions, no observed visibility impacts or ozone-related plant injury in the national seashore, and regional SUM06 values, with very little influence from existing or forecast national seashore watercraft operations.

Implementation of this alternative would not result in an impairment of air quality related values.

Impacts of Alternative B: Reinstate PWC Use under a Special NPS Regulation with Additional Management Prescriptions (Preferred Alternative)

Analysis. Under alternative B, the annual number of PWC using the Cape Lookout National Seashore would be the same as alternative A. Additional management prescriptions under alternative B, including the adoption of special use areas, would not affect PWC use numbers and potential future increases. The predicted emission levels and impacts of continued PWC use to air quality related values would be similar to those described for alternative A based on annual emission rates. The assumed daily duration of PWC use would decrease from 10 minutes under alternative A to 5 minutes under alternative B for both 2003 and 2013. Impacts on air quality related values from PWC in 2003 and 2013 would be negligible.

Cumulative Impacts. Cumulative adverse impacts on air quality related values at the national seashore in both 2003 and 2013 would be the same as described under alternative A. HC contribution to ozone-related air quality values would be negligible. In 2013, NO_x emissions would slightly increase but would remain well below 50 tons per year, and there would be a reduction in HC emissions, resulting in a reduced contribution to ozone levels relative to 2003. Predicted year 2013 regional SUM06 ozone levels would be in the same range as year 2003; the impact would remain negligible.

Conclusion. The impacts of alternative B on air quality related values would be the same as alternative A. Emissions of each pollutant would be substantially less than 50 tons per year in both 2003 and 2013. Compared to the no-action alternative, projected emission increases due to PWC use (as shown in table 30). Negligible adverse impacts on air quality related values from PWC would occur in both 2003 and 2013. In both 2003 and 2013, adverse impacts from cumulative emissions from motorized boats and PWC would be negligible. This conclusion is based on calculated levels of pollutant emissions (table 31), regional SUM06 values, and the lack of observed visibility impacts or ozone-related plant injury in the national seashore.

Implementation of this alternative would not result in an impairment of air quality related values.

SOUNDSCAPES

The primary soundscape issue relative to PWC use is that other visitors may perceive the sound made by PWC as an intrusion or nuisance, thereby disrupting their experiences. This disruption is generally short-term because PWC is generally used as transportation to and from the islands. However, if PWC use would increase and concentrate at popular visitation areas, such as Shackleford Banks and the lighthouse, related noise would become more of an issue, particularly during certain times of the day. Additionally, visitor sensitivity to PWC noise varies from kayakers (more sensitive) to swimmers at popular beaches (less sensitive).

GUIDING REGULATIONS AND POLICIES

The national park system includes some of the quietest places on earth, as well as a rich variety of sounds intrinsic to park environments. These intrinsic sounds are recognized and valued as a park resource, in keeping with the NPS mission (*NPS Management Policies 2001,* sec. 1.4.6 [NPS 2001d]), and are referred to as the park's natural soundscape. The natural soundscape, sometimes called natural quiet, is the aggregate of all the natural sounds that occur in parks, absent human-caused sound, together with the physical capacity for transmitting the natural sounds (*NPS Management Policies 2001,* sec. 4.9 [NPS 2001d]). It includes all of the sounds of nature, including such "non-quiet" sounds as birds calling, waterfalls, thunder, and waves breaking against the shore. Some natural sounds are also part of the biological or other physical resource components of parks (e.g., animal communication, sounds produced by wind in trees, thunder or running water).

NPS policy requires the restoration of degraded soundscapes to the natural condition whenever possible, and the protection of natural soundscapes from degradation due to noise (undesirable human-caused sound) (*NPS Management Policies 2001,* sec. 4.9 [NPS 2001d]). The NPS is specifically directed to "take action to prevent or minimize all noise that, through frequency, magnitude, or duration, adversely affects the natural soundscape or other park resources or values, or that exceeds levels that have been identified as being acceptable to, or appropriate for, visitor uses at the sites being monitored" (*NPS Management Policies 2001,* sec. 4.9 [NPS 2001d]). Overriding all of this is the fundamental purpose of the national park system, established in law (16 USC 1 et seq.), which is to conserve park resources and values (*NPS*

Management Policies 2001, sec. 1.4.3 [NPS 2001d]). NPS managers must always seek ways to avoid, or to minimize to the greatest degree practicable, adverse impacts on park resources and values (*NPS Management Policies 2001,* sec. 1.4.3 [NPS 2001d]).

Noise can adversely affect park resources, including but not limited to natural soundscapes. It can directly impact them, for example, by modifying or intruding upon the natural soundscape. It can also indirectly impact resources, for example, by interfering with sounds important for animal communication, navigation, mating, nurturing, predation, and foraging functions.

Noise can also adversely impact park visitor experiences. The term "visitor experience" can be defined as the opportunity for visitors to experience a park's resources and values in a manner appropriate to the park's purpose and significance, and appropriate to the resource protection goals for a specific area or management zone within that park. In other words, visitor experience is primarily a resource-based opportunity appropriate to a given park or area within a park, rather than a visitor-based desire. Noise impacts on visitor experience can be especially adverse when management objectives for visitor experience include solitude, serenity, tranquility, contemplation, or a completely natural or historical environment. Management objectives (also called desired conditions) for resource protection and visitor experience are derived through well-established public planning processes from law, policy, regulations, and management direction applicable to the entire national park system and to each specific park unit.

Visitor uses of parks will only be allowed if they are appropriate to the purpose for which a park was established, and if they can be sustained without causing unacceptable impacts on park resources or values (*NPS Management Policies 2001,* sec. 8.1 and 8.2 [NPS 2001d]). While the fundamental purpose of all parks also includes providing for the "enjoyment" of park resources and values by the people of the United States, enjoyment can only be provided in ways that leave the resources and values unimpaired for the enjoyment of future generations (*NPS Management Policies 2001,* sec. 1.4.3 [NPS 2001d]). Unless mandated by statute, the NPS will not allow visitors to conduct activities that, among other things, unreasonably interfere with "the atmosphere of peace and tranquility, or the natural soundscape maintained in wilderness and natural, historic, or commemorative locations within the park" (*NPS Management Policies 2001,* sec. 8.2 [NPS 2001d]). While many visitor activities are allowed or even encouraged in parks consistent with the above policies, virtually all visitor activities are limited or restricted in some way (e.g., through carrying-capacity determinations, implementation plans, or visitor use management plans), and on a park- or area-specific basis, some visitor activities are not allowed at all.

The degree to which a given activity (e.g., PWC use) is consistent with, or moves the condition of a resource or a visitor experience toward or away from a desired condition, is one measure of the impact of the activity.

The federal regulation pertaining to noise abatement for boating and water use activities (36 CFR 3.7) prohibits operating a vessel on inland waters "so as to exceed a noise level of 82 decibels measured at a distance of 82 feet (25 meters) from the vessel" and specifies that testing procedures to determine such noise levels should be in accordance with or exceed those established by the Society of Automotive Engineers (SAE) in "Exterior Sound Level Measurement Procedure for Pleasure Motorboats" (J34). This SAE procedure specifies that sound level measurements be taken 25 meters perpendicular to the line of travel of the vessel at full throttle (SAE 2001). It is important to note that this NPS regulation and the SAE procedure were developed for enforcement purposes, not impact assessment purposes. The level in the regulation does not imply that there are no impacts on park resources or visitor experiences at levels below 82 dB; it just indicates that noise levels from vessels legally operating on NPS waters will be no "louder" than 82 dB. As explained elsewhere in this document, a single decibel value does not provide much information for impact assessment purposes.

In addition to NPS policies, North Carolina has adopted legislation that regulates PWC operation. The following elements of North Carolina PWC regulations have impacts on national seashore soundscapes:

- *Timing restrictions* – No one can operate a PWC on state waters between sunset and sunrise.

- *Location restrictions* – No person shall operate a PWC on the waters of the state at greater than no-wake speed within 100 feet of an anchored or moored vessel, a dock, pier, swim float, marked swimming area, swimmers, surfers, persons engaged in angling, or any manually operated propelled vessel, unless the PWC is operating in a narrow channel, where the distance is reduced to 50 feet (a narrow channel is defined as a segment of water 300 feet or less in width).

Natural noise sources at Cape Lookout National Seashore include surf, winds blowing across water, and bird calls. Man-made noise sources at the Beaufort Inlet area include powerboats, PWC, commercial vessels, background noise from the town of Beaufort, and small aircraft. Such noise decreases considerably in the national seashore's northern stretches.

METHODOLOGY AND ASSUMPTIONS

The methodology used to assess PWC-related noise impacts in this document is consistent with *NPS Management Policies 2001* (NPS 2001d), *Director's Order #47: Soundscape Preservation and Noise Management*, and the methodology being developed for the reference manual for *Director's Order #47* (NPS 2000b). Specific factors at Cape Lookout related to context, time, and intensity are discussed below and are then integrated into a discussion of the impact thresholds used in this analysis.

Context: Existing background noise levels at Cape Lookout National Seashore are influenced by wave action (particularly on the oceanside), wind, visitor activities, other boats, hunters, and off-road use on the islands. The national seashore receives the highest amount of visitation and related noise on summer weekends, particularly holidays. However, even on busy weekends, the northern areas of the national seashore provide opportunities for natural quiet.

Soundscape disturbances at Cape Lookout National Seashore are concentrated at the west end of Shackleford Banks and the lighthouse area, which are the most easily accessible to visitors. North Carolina PWC regulations limit PWC to no-wake speed within 100 feet of an anchored or moored vessel, dock, pier, swim float, marked swimming area, swimmers, surfers, anglers, or any manually operated propelled vessel. This limitation is reduced to 50 feet when in a narrow channel of 300 feet or less in width.

Time Factors: *Time Periods of Interest* — PWC use occurs primarily during mid-day on summer weekends. Use decreases to almost zero in winter months. State law restricts use to the hours between sunrise and sunset. Use generally stops during periods of inclement weather (e.g., cold and thunderstorms).

Time periods of greater sensitivity to noise impacts include sunset, sunrise, and night time when campers may be present and wildlife may be more active.

Duration and Frequency of Occurrence of Noise Impacts — In areas of concentrated PWC use, noise from PWC (and other boat types) can be present intermittently from early morning to sunset. In areas of low use, noise from PWC (and other boat types) can be occasional, usually lasting a few minutes. On peak days, an average of 36 PWC would have been expected at Shackleford Banks in 2003, 21 at South Core Banks, and 3 at North Core Banks. Because the NPS jurisdiction is so

narrow (150 feet from mean low tide), it is estimated that each PWC would operate for only 10 minutes per day within NPS waters under alternative A, and only 5 minutes per day within NPS waters under alternative B since they must approach the shoreline at a perpendicular angle. PWC could operate for a much longer duration outside of NPS jurisdiction; however, it assumed that PWC operating within national seashore waters are doing so to access the islands, not for recreation.

Intensity: Some literature states that all recently manufactured watercraft emit fewer than 80 dB at 50 feet from the vessel, while other sources attribute levels as high as 102 dB without specifying distance.

Noise limits established by the NPS require vessels to operate at less than 82 dB at 82 feet from the vessel. PWC noise travels in relationship to the speed of the craft, the distance from shoreline, and other influences. Outdoor noise levels usually decrease with increasing distance from the source because of geometrical spreading of the noise over a bigger surface and absorption of the noise by the atmosphere and the ground (Bruer and Kjaer 2002). According to Komanoff and Shaw (2000), PWC noise dissipates by 5 dBA across water for each doubling of distance from a 20-foot circle around the source and by 6 dBA across land. A PWC engine in the water produces 80 dB of sound within a 20-foot radius, and 73 dB within a 50-foot radius (Komanoff and Shaw 2000). This is close to estimates provided by the Personal Watercraft Industry Association, which state that one PWC operating 50 feet from an onshore observer is heard at 71 dBA, and two would be heard at 74 dBA (PWIA 2002b).

The NPS contracted for noise measurements of PWC and other motorized vessels in 2001 at Glen Canyon National Recreation Area (Harris, Miller, Miller & Hanson, Inc. 2002). The results show that maximum PWC noise levels at 50 feet ranged from 68 to 76 dBA. Noise levels for other motorboat types measured during that study ranged from 65 to 86 dBA at 50 feet. However, PWC-generated noise may be more disturbing due to rapid changes in acceleration and direction of noise than noise from a constant source at 90 dB (EPA 1974, cited in Izaak Walton League 1999).

Vegetation can also decrease noise. According to the Federal Highway Administration (2000), vegetation must be so high, wide, and dense that it cannot be seen through, and must be at least 61 meters (186 feet) wide to reduce noise by 10 dB. With the exception of the maritime forest located in a small area on Shackleford Bank's soundside, Cape Lookout has very little shoreline vegetation, so vegetation is not an attenuating factor. Based on Komanoff and Shaw's more conservative projections, PWC noise levels at Cape Lookout would be 73 dBA when operating 50-feet from the shoreline, decreasing to 68 dBA 100 feet from the shoreline, and 63 dBA 200 feet from the shoreline (assuming PWC are operating at normal speed).

In response to public complaints, the PWC industry has employed new technologies to reduce sound by about 50% to 70% on 1999 and newer models (Sea-Doo 2000; Hayes 2002). Additionally, by 2006 the EPA requirements will reduce PWC noise, in association with improvements to engine technology (EPA 1996b).

Context, time, and intensity together determine the level of impact for an activity. For example, noise for a certain period and intensity would be a greater impact in a highly sensitive context, and a given intensity would result in a greater impact if it occurred more often, or for longer duration. It is usually necessary to evaluate all three factors together to determine the level of noise impact. In some cases an analysis of one or more factors may indicate one impact level, while an analysis of another factor may indicate a different impact level, according to the criteria below. In such cases, best professional judgment based on a

documented rationale must be used to determine which impact level best applies to the situation being evaluated.

To estimate the relative impacts of PWC use at Cape Lookout, the following methodology was applied:

1. National literature was used to estimate the average decibel levels of PWC.
2. Areas of shoreline use by other visitors were identified in relation to where PWC users launch and operate offshore. Personal observation from park staff and PWC counts were used to identify these areas, as well as determine the number of PWC and the time of use.
3. Other considerations, such as topography and prevailing winds, were then used to identify areas where PWC noise levels could be exacerbated or minimized.

Sound levels generated by motorized craft using the national seashore are expected to affect recreational users differently. For example, visitors participating in less sound-intrusive activities such as camping would likely be more adversely affected by PWC noise than another PWC or motorboat user. Therefore, impacts on soundscapes must take into account the effect of noise levels on different types of recreational users within the study area. The following is a list of other considerations for evaluating sound impacts:

- The estimated typical maximum number of PWC that would have operated in 2003 is 36 per day in Shackleford Banks, 21 in South Core Banks (including the popular lighthouse area), and 3 in North Core Banks. Under present trends typical high-use numbers are expected to increase to 48, 28, and 4, respectively, by 2013. As mentioned above, it is estimated that each PWC would operate for only 10 minutes per day within NPS waters under alternative A, and only 5 minutes per day within NPS waters under alternative B since they must approach the shoreline at a perpendicular angle.

- North Carolina PWC regulations limit PWC to no-wake speed within 100 feet of an anchored or moored vessel, dock, pier, swim float, marked swimming area, swimmers, surfers, anglers, or any manually operated propelled vessel. Therefore, it assumed that PWC are operating at no-wake speeds within 100 feet of the vessels, docks, swimmers, anglers, and other beach users in the popular Shackleford Banks and lighthouse areas; noise levels from this activity would be low and for short duration.

- Ambient noise levels at most locations include wind, waves, other visitors, and other motorboats. Other motorboats outnumber PWC throughout the national seashore, depending on location. Approximately 420 boats were operating on a high-use day in 2003 at Shackleford Banks, 284 at South Core Banks, and 24 at North Core Banks. These numbers are assumed to increase to 495, 334, and 24 in 2013.

All of these factors combine to lessen the overall impact of noise from PWC use.

IMPACT ANALYSIS AREA

The impact analysis area for soundscapes is the national seashore's jurisdictional boundary, which includes all waters from the mean low water line on the oceanside to 150 feet beyond the mean low water line on the soundside. At low tide, only the soundside waters are under the park's jurisdiction.

The study area for soundscapes is related to the location that PWC operate and the distance that PWC noise travels. Historically (before the closure) PWC were allowed to operate anywhere within the national

seashore. Because few, if any, PWC used the national seashore's oceanside of the islands, the study area for soundscapes is the 150 feet beyond the mean low water line on the soundside of Cape Lookout National Seashore's islands.

IMPACT TO VISITORS FROM NOISE GENERATED BY PERSONAL WATERCRAFT

After estimating the number of PWC, the range of relative noise generated by them, and the potential areas where noise concentrations and effects on other visitors may be of concern, the following thresholds were used as indicators of the magnitude of impact for each of the PWC management alternatives:

Negligible: Natural sounds would prevail; motorized noise would be very infrequent or absent, mostly immeasurable.

Minor: Natural sounds would predominate in areas where management objectives call for natural processes to predominate, with motorized noise infrequent at low levels. In areas where motorized noise is consistent with park purpose and objectives, motorized noise could be heard frequently throughout the day at moderate levels, or infrequently at higher levels, and natural sounds could be heard occasionally.

Moderate: In areas where management objectives call for natural processes to predominate, natural sounds would predominate, but motorized noise could occasionally be present at low to moderate levels. In areas where motorized noise is consistent with park purpose and objectives, motorized noise would predominate during daylight hours and would not be overly disruptive to noise-sensitive visitor activities in the area; in such areas, natural sounds could still be heard occasionally.

Major: In areas where management objectives call for natural processes to predominate, natural sounds would be impacted by human noise sources frequently or for extended periods of time at moderate intensity levels (but no more than occasionally at high levels), and in a minority of the area. In areas where motorized noise is consistent with park purpose and zoning, the natural soundscape would be impacted most of the day by motorized noise at low to moderate intensity levels, or more than occasionally at high levels; motorized noise would disrupt conversation for long periods of time and/or make enjoyment of other activities in the area difficult; natural sounds would rarely be heard during the day.

Impairment: The level of noise associated with PWC use would be heard consistently and would be readily perceived by other visitors throughout the day, especially in areas where such noise would potentially conflict with the intended use of that area. In addition, these adverse, major impacts on park resources and values would

contribute to deterioration of the park's soundscape to the extent that the park's purpose could not be fulfilled as established in its authorizing legislation;

affect resources key to the park's natural or cultural integrity or opportunities for enjoyment; or

affect the resource whose conservation is identified as a goal in the park's general management plan or other park planning documents.

Impacts of the No-Action Alternative: Continue Prohibition of PWC Use in Cape Lookout National Seashore

Analysis. Under the no-action alternative PWC would continue to be banned from operating within Cape Lookout National Seashore. Because the PWC ban has been in effect since 2002, continuation of the ban would result in no change to current soundscapes, and PWC would not contribute to noise impacts within national seashore boundaries.

Cumulative Impacts. Because the islands can only be accessed by boat, other motorized boating activities would continue to have short-term, minor, adverse noise impacts throughout the day. The highest level of impact would occur near the west end of Shackleford Banks and the Cape Lookout area at the southern end of South Core Banks — the national seashore's most popular locations. Visitation to the Cape Lookout area is expected to increase substantially when the national seashore opens the lighthouse to the public in 2005, increasing the amount of motorized vessels and noise in this area. Impacts would be reduced to negligible farther north, particularly between Long Point and Portsmouth Village on North Core Banks, where visitation is low. The *Cape Lookout National Seashore: Superintendent's Compendium* (NPS 2003b) limits boat mooring at Long Point and Great Basin boat basins to a maximum of 15 minutes to load and unload, effectively making these docking locations shuttle or ferry destinations and limiting the amount of noise generated by private boats in these areas.

Other visitor uses contribute to the area's soundscape, including beach activities, hunting, swimming and shelling, fishing, camping, and off-road vehicle use on South and North Core Banks. However, these sounds are considered acceptable and compatible with other national seashore uses, and hunting typically occurs in fall and winter, when overall visitation is low. Off-road vehicle use occurs only on the oceanside of the islands (with the exception of Shackleford Banks, where off-road use is prohibited), and would not impact noise on the soundside of the islands. When combined with no effects expected under this alternative, overall cumulative impacts would be adverse, short-term, and negligible to minor depending on location and type of activity involved.

Conclusion. Continuation of the PWC ban would result in no change to soundscapes at the national seashore, and there would be no contribution to noise impacts from PWC within national seashore boundaries.

Cumulative noise impacts from motorboats, off-road vehicles, and other visitor activities would be short-term, negligible to minor, and adverse, concentrated particularly on the western end of Shackleford Banks and the Cape Lookout area on the south end of South Core Banks.

Implementation of this alternative would not result in an impairment of the national seashore's soundscape.

Impacts of Alternative A: Reinstate PWC Use under a Special NPS Regulation as Previously Managed

Analysis. Under alternative A, PWC use would be reinstated within Cape Lookout National Seashore with no additional PWC restrictions. All areas under legal jurisdiction of Cape Lookout would be open to PWC use and access. The average maximum number of PWC estimated to have operated in 2003 is 36 per day in Shackleford Banks, 21 in South Core Banks (including the popular lighthouse area), and 3 in North Core Banks. These numbers represent high-use holiday weekends.

North Carolina boating regulations state that PWC must operate at no greater than no-wake speed within 100 feet of an anchored or moored vessel, a dock, pier, swim float, marked swimming area, swimmers,

surfers, anglers, propelled vessel, unless the PWC is operating in a narrow channel, which limits the no-wake zone to 50 feet. PWC users accessing the national seashore's most popular day-use areas would be operating among numerous vessels, swimmers, and surfers, and (if operating in compliance with state regulations) would be required to operate at the quieter no-wake speed in these areas. PWC operators traveling at no-wake speeds do not generate substantial noise.

At 50 feet from the shoreline one PWC generates approximately 73 dB, which is below the noise limit established by the Park Service (82 dB at 82 feet or 25 meters). At 200 feet from the shoreline the sound level would decrease to 63 dB, which is in the realm of "quiet" as defined in table 8 in the "Affected Environment" chapter.

Noise impacts from PWC use would be greatest on the west end of Shackleford Banks and in the cove at Cape Lookout at the south end of South Core Banks. These are the national seashore's most popular day-use areas and were historically popular with PWC users as well.

Boaters who camp along the shoreline may be more sensitive to sound levels and PWC activity. PWC use adjacent to shoreline campers would have negligible adverse impacts on the soundscape because related noise would be heard only during daytime hours, when boat campers may have left the campsite to participate in beach-related activities, and because the background noise of the surf would mask other noises in the area.

Noise impacts from PWC under alternative A are expected to be short-term, negligible to minor, and adverse. Negligible impacts would occur when use is infrequent and along the national seashore's more remote areas, specifically North Core Banks. Moderate impacts would occur from concentrated use during the peak season, particularly on the west end of Shackleford and in the cove and Cape Lookout, where swimmers, anglers, and beach users are present. Noise would likely be the most concentrated in the Barden Inlet, which motorized vessels use to access Cape Lookout. As described under the no-action alternative, PWC use would be infrequent farther north, particularly in North Core Banks, where no PWC use was recorded during the Memorial Weekend holiday in 2000. Therefore, impacts from PWC use along Core Sound would be adverse but negligible.

In general, impacts on those seeking a quiet visitor experience would most likely be negligible to minor because PWC use would not be constant throughout the day, and the overall enjoyment of visitors would not be compromised. In addition, visitors know that all of the national seashore's islands can only be accessed by watercraft, likely making the sounds of motorized vessels more acceptable at Cape Lookout than other national park units. All noise impacts would be short-term, since noise would generally be for a limited duration. Impacts could be reduced over the long-term as a result of new technologies to reduce sound levels on 1999 and newer models (Sea-Doo 2000; Hayes 2002). Additionally, by 2006 the EPA requirements will result in reduced noise levels in association with improved engine technology (EPA 1996b).

Cumulative Impacts. Noise from PWC use would combine with noise from other visitor use sources described under alternative A, increasing the amount of overall noise compared to the no-action alternative. Increased visitation to the Cape Lookout lighthouse starting in 2005 would lead to an increase in PWC in that area, as well as motorized boats. Because off-road vehicle use on the South and North Core Banks occurs between the ocean and the dunes, sounds from these vehicles would not combine with noise from PWC, which seldom, if ever, use the ocean waters. Motorboat use is far more prevalent at Cape Lookout National Seashore than PWC historically has been; therefore, additional noise from PWC would result in adverse, short-term, negligible to minor impacts on soundscapes, depending on location and type of activity being pursued.

Conclusion. Impacts from reinstating PWC use throughout the national seashore would be adverse, short-term, and negligible to moderate. Impacts would be negligible where use is infrequent and where visitation is low, and moderate in more congested areas.

Although reinstating PWC use would add an additional noise source to the national seashore's soundscapes, cumulative impacts would remain adverse, short-term, and negligible to moderate given the historically low numbers of PWC use and the high numbers of motorized boats.

Implementation of this alternative would not result in an impairment of the national seashore's soundscape.

Impacts of Alternative B: Reinstate PWC Use under a Special NPS Regulation with Additional Management Prescriptions (Preferred Alternative)

Analysis. Under alternative B, PWC would be reinstated at Cape Lookout in specific locations. PWC would have access to areas that had been historically popular with PWC users; restrictions under this alternative were based on safety reasons or the need to protect natural resources, particularly marshlands, which PWC avoid. However, all PWC operating within the special use areas defined under this alternative would be required to operate at flat-wake speed within the national seashore's boundaries, which includes all waters from the mean low water line on the oceanside to 150 feet beyond the mean low water line on the soundside. In addition, the area consisting predominantly of maritime forest along the soundside of Shackleford Banks would be closed to PWC use for safety reasons due to the high amount of visitor use in this area. Therefore, visitors using this area of Shackleford Banks would not experience adverse impacts because of the absence of PWC noise. Impacts throughout Shackleford Banks would be adverse, short-term, and minor.

The flat-wake speed restrictions would also lessen adverse impacts in the cove at Cape Lookout and the northern areas of the national seashore. PWC would be permitted to dock at specific locations along Core Sound, which were historically used by PWC in the past. Because most of the Core Sound consists of marshlands, PWC use along the South and North Core Banks was low before the ban, even during summer holiday weekends. For these reasons, noise impacts in the national seashore's northern reaches would be adverse, short-term, but negligible.

Cumulative. Combining PWC noise with other noise sources described under the no-action alternative would increase the overall sound level at the national seashore. However, limiting PWC to flat-wake speed in all permitted areas of the national seashore would reduce adverse noise impacts considerably. Increased visitation expected to the Cape Lookout lighthouse would result in increased noise from both motorboats and PWC accessing this area. Therefore, cumulative impacts would be adverse, short-term, and negligible to minor under this alternative, depending on location.

Conclusion. PWC would be permitted in areas historically preferred by PWC users under this alternative, but only at flat-wake speed, resulting in adverse, short-term, negligible to minor impacts, depending on location. Cumulative impacts would be adverse, short-term, and negligible to minor under this alternative, depending on location.

Implementation of this alternative would not result in an impairment of the national seashore's soundscape.

SHORELINE VEGETATION AND SUBMERGED AQUATIC VEGETATION

PWC are able to access areas that other types of watercraft may not, which may cause direct disturbance to vegetation. Indirect impact to shoreline vegetation may occur through trampling if operators disembark and engage in activities on shore. In addition, wakes created by PWC may affect shorelines through erosion by wave action.

PWC are very maneuverable and can operate well in waters less than a foot deep. Since most PWC rides begin in shallow water, the process of getting started from a standstill results in a substantial amount of water being directed towards the bottom at high velocity, potentially disturbing the sediment and submerged aquatic vegetation in shallow water areas. Disturbance of submerged aquatic vegetation beds diminishes their ecological value and productivity, affecting the entire ecosystem. As PWC are frequently operated in shallow areas in a repetitive manner, impacts on submerged aquatic vegetation beds can be severe. Potential direct impacts on submerged aquatic vegetation beds by PWC can occur through collision, uprooting of submerged aquatic vegetation, and alteration of natural sediments. Potential indirect impacts of PWC use include adverse effects on the growth and health of submerged aquatic vegetation beds as a result of increased turbidity, decreased available sunlight, and deposition of suspended sediment on plants.

GUIDING REGULATIONS AND POLICIES

According to NPS management policy, natural shoreline processes such as erosion, deposition, overwash, inlet formation, and shoreline migration should continue without interference. Where the nature or rate of natural shoreline processes has been altered, the NPS is directed to identify alternatives for mitigating the effects of such activities or structures and for restoring natural conditions (*NPS Management Policies 2001,* sec. 4.8.1.1 [NPS 2001d]). The NPS must also comply with the provisions of Executive Order 11990 “Protection of Wetlands,” which requires federal agencies to avoid short- and long-term adverse impacts associated with the destruction or modification of wetlands whenever possible.

METHODOLOGY AND ASSUMPTIONS

PWC have the potential to impact shoreline vegetation and submerged aquatic vegetation as a result of operating in shallow waters or adjacent to wetland habitats. Direct impacts resulting from collision or mechanical removal can occur. Potential indirect impacts include the deposition of suspended sediments on aquatic or submerged vegetation or modification of substrates.

Impacts on shoreline vegetation associated with foot traffic adjacent to landing zones can also occur. Primary steps in assessing impacts on shoreline vegetation and submerged aquatic vegetation were to determine (1) occurrence and location of vegetation in areas likely to be affected by management actions described in the PWC alternatives, (2) current and future use and distribution of PWC by alternative, (3) habitat impact or alteration caused by the alternatives, and (4) disturbance potential of the actions and the potential to affect shoreline or aquatic vegetation as a result of PWC activities. The information contained in this analysis was obtained through best professional judgment of park staff and experts in the field, and by conducting literature review.

IMPACTS ON SHORELINE VEGETATION AND SUBMERGED AQUATIC VEGETATION FROM PWC USE

The following thresholds were used to determine the magnitude of effects on shoreline vegetation and submerged aquatic vegetation communities:

Negligible: No shoreline vegetation or submerged aquatic vegetation communities are present in areas likely to be accessed by PWC; no impacts or impacts with only temporary effects are expected.

Minor: Shoreline vegetation or submerged aquatic vegetation communities are present, but only in low numbers. Occasional impacts on species or communities are expected, but with no impacts or limited impacts on the continued existence of the species or viable functioning communities within the national seashore.

Moderate: Shoreline vegetation or submerged aquatic vegetation communities are present in areas accessible by PWC. Direct loss of vegetation or other effects are expected on an occasional basis, but are not expected to threaten the continued existence of the species or viable functioning communities in the national seashore.

Major: Shoreline vegetation or submerged aquatic vegetation communities are present in relatively high numbers in areas accessible by PWC. Direct loss of vegetation or other effects are expected on a regular basis and could threaten continued survival of species or communities of species in the park.

Impairment: PWC use would contribute substantially to the deterioration of the shoreline or shallow water environment to the extent that the park's shoreline or submerged vegetation would no longer function as a natural system. In addition, these adverse major impacts on park resources and values would:

contribute to deterioration of these resources to the extent that the park's purpose could not be fulfilled as established in its enabling legislation;

affect resources key to the park's natural or cultural integrity or opportunities for enjoyment; or

affect the resource whose conservation is identified as a goal in the park's general management plan or other park planning documents.

Impacts of the No-Action Alternative: Continue Prohibition of PWC Use in Cape Lookout National Seashore

Analysis. Under this alternative, PWC operation would continue to be prohibited in all jurisdictional waters of Cape Lookout National Seashore. This would reduce the amount of foot traffic in vegetated areas around landing areas and would eliminate adverse impacts from PWC on tidal marsh habitat within the park boundaries.

Cumulative Impacts. Although PWC would continue to not have access to the national seashore, foot traffic associated with non-PWC users would continue. PWC use would not contribute to motorized vessel impacts on shoreline vegetation or submerged aquatic vegetation beds, but other motorized vessels would still be able to operate among submerged aquatic vegetation beds in park waters and adversely affect this habitat. Direct impacts would include propeller scarring, collision, uprooting, and sediment

alteration. Indirect impacts would include increased turbidity, decreased available sunlight, and deposition of suspended sediment which adversely affects the growth and health of submerged aquatic vegetation beds. Because of the short trip lengths and the slow speeds at which vessels generally travel within park waters, impacts on submerged aquatic vegetation beds from non-PWC motorized vessel use are expected to be minor. Foot traffic would continue to have negligible to minor, indirect impacts on shoreline vegetation.

Conclusion. Continuing the prohibition on PWC use would result in no impacts on shoreline vegetation and submerged aquatic vegetation beds in park waters. Impacts associated with the operation of other vessels are expected to be adverse, direct and indirect, negligible to minor, and short- and long-term because most submerged aquatic vegetation beds could still be accessed, resulting in potential damage and loss of this habitat, as well as sediment resuspension and its effects. In addition, foot traffic would continue from other watercraft, causing negligible to minor indirect impact on shoreline vegetation.

Implementation of this alternative would not result in an impairment of shoreline vegetation and submerged aquatic vegetation beds.

Impacts of Alternative A: Reinstate PWC Use under a Special NPS Regulation as Previously Managed

Analysis. Under alternative A, PWC use would be reinstated in all waters within Cape Lookout National Seashore as previously managed under the *Cape Lookout National Seashore: Superintendent's Compendium* NPS 2003b), and all state regulatory requirements would apply. PWC operation could occur throughout park waters, especially in the high-use areas around Shackleford Banks and in Lookout Bight. Direct impacts from PWC use to shoreline vegetation would occur around landing areas that are vegetated, because of vegetation being trampled by foot traffic. Impacts on shoreline vegetation associated with low salt marsh habitats could be expected where PWC users access shallow inter-tidal zones, resulting in plants being removed or damaged by impacts. These habitats are common along the park coastline in Back and Core Sounds and near Catfish Point. However, PWC users tend to avoid marshes and shallow water areas to prevent damage to their craft; therefore, adverse impacts would be expected to be short-term and minor due to limited access to shallow water habitats.

As extensive submerged aquatic vegetation beds occur in park waters in Back and Core Sounds, PWC use in these areas could impact submerged aquatic vegetation beds. However, the slow speeds and short trip lengths characteristic of PWC use in the park are unlikely to damage or destroy submerged aquatic vegetation beds or cause significant sediment resuspension and related effects. Reinstating PWC use within park waters would result in impacts that are negligible, direct and indirect, short- and long-term.

Cumulative Impacts. Motorized vessels, including PWC, would be able to operate throughout park waters. Adverse direct and indirect cumulative effects associated with future increased use by motorized watercraft, including PWC, would be minor to moderate around landing areas and in tidal marsh habitats. Potential direct impacts on submerged aquatic vegetation beds by all motorized vessels include propeller scarring, collision, uprooting, and sediment alteration. Potential indirect impacts include increased turbidity, decreased available sunlight, and suspended sediment deposition on submerged aquatic vegetation beds. However, both PWC and non-PWC trip lengths are short and speeds are low, which reduces the likelihood of adverse impacts. As PWC are outnumbered by non-PWC in park waters by more than 10 to 1, most impacts on shoreline vegetation and submerged aquatic vegetation beds would be attributed to non-PWC. Impacts on shoreline vegetation and submerged aquatic vegetation beds from all types of motorized vessels under this alternative are expected to be minor, direct and indirect, and short- and long-term.

Conclusion. Impacts on shoreline vegetation from foot traffic associated with PWC access to beach areas, and to marsh habitats from PWC use in shallow water habits, would be short-term, indirect, and minor because of low levels of PWC use in affected areas and limited access to marshes and other shallow water habitats.

Reinstating PWC use at Cape Lookout National Seashore would have impacts on submerged aquatic vegetation beds that are direct and indirect, negligible to minor, and short- and long-term. Cumulative impacts on shoreline vegetation and submerged aquatic vegetation habitats by all motorized vessels would be minor.

Implementation of this alternative would not result in an impairment of shoreline vegetation and submerged aquatic vegetation beds.

Impacts of Alternative B: Reinstate PWC Use under a Special NPS Regulation with Additional Management Prescriptions (Preferred Alternative)

Analysis. Under alternative B, PWC use would be allowed within 10 designated access areas, as identified in the "Alternatives" chapter. PWC operation within these access areas would be restricted to a perpendicular approach to the shoreline at flat-wake speed. PWC operation would be prohibited in park waters outside of the access areas. All state regulatory requirements would continue to apply.

These 10 designated access areas were chosen to avoid marshes and high-congestion beach areas. Indirect impacts from PWC use to shoreline vegetation would occur but would be limited to the designated access areas and would therefore be negligible to minor and short-term. Impacts on shoreline vegetation associated with low salt marsh habitats would not occur, since PWC use would be restricted in these areas.

As PWC operation would be prohibited in park waters outside of the access areas, submerged aquatic vegetation beds in these areas would not be directly impacted by PWC use. Most of the access areas do not contain submerged aquatic vegetation beds, so PWC operation in these areas would have little potential to adversely impact this habitat. Additionally, the flat-wake speed restriction would minimize the potential for PWC to damage submerged aquatic vegetation beds through collision or uprooting and would reduce sediment resuspension and its detrimental effects. Reinstating PWC use in park waters and restricting their operation to a flat-wake perpendicular approach to the shoreline in designated access areas would result in negligible, indirect short- and long-term impacts on submerged aquatic vegetation beds.

Cumulative Impacts. Under alternative B, PWC use would be limited to flat-wake speed within ten designated access areas, resulting in a negligible contribution to cumulative impacts on shoreline vegetation and submerged aquatic vegetation beds. Adverse direct and indirect cumulative effects associated with future increased use by motorized watercraft, including PWC, would be minor around landing areas and in tidal marsh habitats. Non-PWC motorized vessels would be able to operate throughout park waters, including areas where submerged aquatic vegetation beds occur. Potential direct impacts on submerged aquatic vegetation beds by all motorized vessels include propeller scarring, collision, uprooting, and sediment alteration. Potential indirect impacts include increased turbidity, decreased available sunlight, and suspended sediment deposition on submerged aquatic vegetation beds. However, both PWC and non-PWC trip lengths are short and speeds are low, which reduces the likelihood of adverse impacts. As PWC are outnumbered by non-PWC in park waters by more than 10 to 1, and most PWC use would not occur around submerged aquatic vegetation beds, nearly all impacts on shoreline vegetation and submerged aquatic vegetation beds would be attributed to non-PWC vessels.

Impacts on shoreline vegetation and submerged aquatic vegetation beds from all types of motorized vessels under this alternative are expected to be minor, direct and indirect, and short- and long-term.

Conclusion. Reinstating PWC use in park waters and restricting their operation to a flat-wake perpendicular approach to the shoreline in designated access areas is expected to have negligible, indirect short-term impacts on submerged aquatic vegetation beds and negligible to minor short-term impacts on shoreline vegetation. Non-PWC would still be able to access submerged aquatic vegetation beds under this alternative, and would be responsible for nearly all of the cumulative motorized vessel impacts on submerged aquatic vegetation beds. Motorized vessels, including PWC, are expected to have minor, direct and indirect, short- and long-term cumulative impacts on shoreline vegetation and submerged aquatic vegetation beds.

Implementation of this alternative would not result in an impairment of shoreline vegetation and submerged aquatic vegetation beds.

WILDLIFE AND WILDLIFE HABITAT

Some research suggests that PWC use affects wildlife by causing interruption of normal activities, alarm or flight, avoidance or degradation of habitat, and effects on reproductive success. This is thought to be a result of a combination of PWC speed, noise, and ability to access sensitive areas, especially in shallow-water depths.

Waterfowl and nesting birds are the most vulnerable to PWC. Fleeing a disturbance created by PWC may force birds to abandon eggs during crucial embryo development stages, prevent nest defense from predators, or contribute to stress and associated behavior changes.

Potential impacts on sensitive species, such as loggerhead sea turtles and piping plover, are documented in the “Threatened, Endangered, or Special Concern Species” section.

GUIDING REGULATIONS AND POLICIES

The *NPS Organic Act of 1916*, which directs parks to conserve wildlife unimpaired for future generations, is interpreted by the agency to mean that native animal life should be protected and perpetuated as part of the park’s natural ecosystem. Natural processes are relied on to control populations of native species to the greatest extent possible; otherwise they are protected from harvest, harassment, or harm by human activities. According to *NPS Management Policies 2001* (NPS 2001d), the restoration of native species is a high priority (sec. 4.1). Management goals for wildlife include maintaining components and processes of naturally evolving national seashore ecosystems, including natural abundance, diversity, and the ecological integrity of plants and animals.

The land area of Shackleford Banks is a proposed wilderness zone and managed as such. Shackleford Banks is home to 110-130 feral horses, which are protected and maintained according to the park’s federal legislation. Management of the feral horses includes monitoring of population growth and mortality (NPS 2004).

The *Cape Lookout National Seashore: Superintendent’s Compendium* (NPS 2003b) for Cape Lookout National Seashore outlines various closures in place to protect wildlife and wildlife habitat. These closures are subject to change and additional closures may be enacted as park staff observe the need for further protection of sensitive species areas.

The mission of Cape Lookout National Seashore is to "conserve and preserve for the future the outstanding natural resources of a dynamic coastal barrier island system." To achieve this, long-term goals stated in Cape Lookout's *Strategic Plan* [NPS 2000c] include the protection, restoration, or maintenance of ecosystems, including rare or endangered plant and animal populations.

METHODOLOGY AND ASSUMPTIONS

Potential impacts on wildlife and wildlife habitat were evaluated based on the pattern of PWC use in the Cape Lookout National Seashore, the nature of habitats and species present, and the professional judgment of the project team and members of the national seashore area staff. Information on wildlife habitat was acquired from national seashore area staff, existing NPS reports, and other public information resources.

Primary steps in assessing impacts on wildlife and wildlife habitat were to determine (1) the potential for species to occur in habitats to be affected by the alternatives being considered, (2) current and future use and distribution of PWC by alternative, (3) habitat impact or alteration caused by the alternatives, and (4) disturbance potential of the actions and the potential to affect wildlife or wildlife habitat as a result of PWC activities. The information contained in this analysis was obtained through best professional judgment of park staff and experts in the field, and by conducting literature review.

MAGNITUDE OF EFFECTS

The following thresholds were used to determine the magnitude of effects on wildlife and wildlife habitat (special concern species are discussed in the "Threatened, Endangered, or Special Concern Species" section):

> *Negligible:* There would be no observable or measurable impacts on native species, their habitats, or the natural processes sustaining them. Impacts would be of short duration and well within natural fluctuations.
>
> *Minor:* Impacts would be detectable, but they are not expected to be outside the natural range of variability or to have any long-term effects on native species, their habitats, or the natural processes sustaining them. Population numbers, population structure, genetic variability, and other demographic factors for species might have small, short-term changes, but long-term characteristics would remain stable and viable. Occasional responses to disturbance by some individuals could be expected, but without interference to feeding, reproduction, or other disruptions that would be within natural variations. Sufficient habitat would remain functional to maintain viability of all species. Impacts would be outside critical reproduction periods for sensitive native species.
>
> *Moderate:* Breeding animals of concern are present; animals are present during particularly vulnerable life-stages, such as migration or juvenile stages; mortality or interference with activities necessary for survival can be expected on an occasional basis, but is not expected to threaten the continued existence of the species in the park unit. Impacts on native species, their habitats, or the natural processes sustaining them would be detectable, and they could be outside the natural range of variability for short periods of time. Population numbers, population structure, genetic variability, and other demographic factors for species might have short-term changes, but would be expected to rebound to pre-impact numbers and to remain stable and viable in the long-term. Frequent responses to disturbance by some individuals could be expected, with some negative

impacts on feeding, reproduction, or other factors affecting short-term population levels. Key ecosystem processes might have short-term disruptions that would be outside natural variation (but would soon return to natural conditions). Sufficient habitat would remain functional to maintain viability of all native species. Some impacts might occur during critical periods of reproduction or in key habitat for sensitive native species.

Major: Impacts on native species, their habitats, or the natural processes sustaining them would be detectable, and they would be expected to be outside the natural range of variability for long periods of time or be permanent. Population numbers, population structure, genetic variability, and other demographic factors for species might have large, short-term declines, with long-term population numbers significantly depressed. Frequent responses to disturbance by some individuals would be expected, with negative impacts on feeding, reproduction, or other factors resulting in a long-term decrease in population levels. Breeding colonies of native species might relocate to other portions of the park. Key ecosystem processes might be disrupted in the long-term or permanently. Loss of habitat might affect the viability of at least some native species.

Impairment: Some of the major impacts described above might be an impairment of park resources if their severity, duration, and timing resulted in the elimination of a native species or substantial population declines in a native species, or they precluded the park's ability to meet recovery objectives for listed species. In addition, these adverse, major impacts on park resources and values would

contribute to deterioration of the park's wildlife resources and values to the extent that the park's purpose could not be fulfilled as established in its enabling legislation;

affect resources key to the park's natural or cultural integrity or opportunities for enjoyment; or

affect the resource whose conservation is identified as a goal in the park's general management plan or other park planning documents.

Study Area: Wildlife and Habitat

The study area includes Cape Lookout National Seashore from the Beaufort Inlet at Shackelford Banks to the eastern boundary of the park at Portsmouth Village.

Impacts of the No-Action Alternative: Continue Prohibition of PWC Use in Cape Lookout National Seashore

Analysis. Under the no-action alternative, there would be no PWC permitted within the park boundaries, which would eliminate impacts on wildlife from PWC use and the associated noise disturbance.

Cumulative Impacts. Under the no-action alternative, motorized vessels, excluding PWC, could have adverse impacts on terrestrial and aquatic wildlife and habitats in park waters, especially in high-use areas. Cumulative impacts would be negligible to minor, short-term adverse indirect impacts related to all other motorized uses. Other motorized watercraft use would continue to occur throughout park waters and may adversely affect aquatic and terrestrial wildlife species, especially in high boating use areas. Impacts on terrestrial wildlife, specifically birds, and dolphins, fish and shellfish, and their habitats from all motorized vessel use are expected to be short-term, minor, direct and indirect, and adverse.

Noise levels and the ability of other motorized watercraft users to access Shackleford Banks are expected to adversely affect terrestrial wildlife and shorebirds and waterfowl that may utilize the landing area and adjacent areas by causing alarm or flight responses. Effects are expected to be minor because Shackleford Banks has a historically high level of visitation, and species sensitive to a high level of noise and human activity would probably not regularly use this area, or immediately adjacent habitats during high use periods.

Dolphins and sea turtles could be adversely impacted by motorized vessel use either directly from injuries received as a result of collisions, or indirectly through engine noise transmitted underwater (effects of underwater noise are discussed below).

More than 200 species of fish probably occur in the waters surrounding Cape Lookout National Seashore. Larval and juvenile stages of many fish and shellfish species inhabit the shallow protected waters around the islands and find food and shelter in seagrass beds. Commercially and recreationally important fish species such as Spanish mackerel, king mackerel, speckled trout, weakfish, jack, bluefish, cobia, tarpon, striped bass, kingfish, black sea bass, red drum, black drum, croaker, gray snapper, summer flounder, and mullet occur within the waters of the national seashore. Commercially significant shellfish occurring in park waters include the hard clam, oyster, bay scallop, shrimp, and blue crab.

Motorized watercraft use could disrupt normal fish and shellfish feeding and other critical life functions by triggering flight responses. Boating in areas providing essential fish habitats for fish and shellfish species, such as shallow protected waters and submerged aquatic vegetation beds could adversely affect suitability of these areas to meet life cycle requirements. Adverse effects could also occur as a result of motorized vessel emissions, sediment resuspension, and destruction of submerged aquatic vegetation beds. Because waters under the park's jurisdiction are shallow and contain numerous shoals, motorized vessels in park waters generally travel slowly to avoid grounding. This minimizes engine emissions, noise production, wave generation, and sediment resuspension, therefore adverse impacts on aquatic wildlife are not expected to be severe.

Short-term, negligible to minor, direct and indirect adverse impacts on aquatic wildlife species and habitats are expected under the no-action alternative.

Conclusion. Under the no-action alternative, there would be no impacts on wildlife from PWC use within the national seashore boundary. On a cumulative basis, negligible to minor, short-term adverse indirect impacts on wildlife would still occur as a result of PWC use adjacent to the national seashore boundary and other motorized uses.

Implementation of this alternative would not result in an impairment of terrestrial or aquatic wildlife or habitats in park waters.

Impacts of Alternative A: Reinstate PWC Use under a Special NPS Regulation as Previously Managed

Analysis. Under this alternative a special NPS regulation would be written to reinstate PWC use within Cape Lookout National Seashore, including all waters within 150 feet from the mean low water mark on the soundside of the park and the oceanside beaches.

Shackleford Banks is in an area that experiences a high level of PWC use, as well as a high level of general visitor use. As a result, associated human activity and noise levels near and at Shackleford Banks are typically higher than in other areas of the park, especially between mid-May and September. Noise

levels and the ability of PWC users to access Shackleford Banks would be expected to adversely affect terrestrial wildlife and shorebirds and waterfowl that may utilize the landing area and adjacent areas by causing alarm or flight responses. Effects are expected to be minor because Shackleford Banks has a generally high level of visitation, regardless of PWC usage, and species sensitive to a high level of noise and human activity would probably not regularly use this area, and specially the PWC landing area, or immediately adjacent habitats during high use periods.

Nesting sites for ground-nesting birds are typically associated with beach or near beach habitats on the Atlantic shore, backbay shores, and small islands associated with Cape Lookout National Seashore. Reactions of various nesting bird species to nearby PWC use can include alarm or flight responses and in some cases abandonment of the nests. However, due to the previous locations of typical use by PWC, species sensitive to their presence would likely not nest in the areas affected by PWC. As stated, nesting sites are typically on the oceanside of the island or in more remote locations.

In addition to Shackleford Banks, the lighthouse at South Core Banks is also an area of high visitation, which contributes to it also being an area of potentially high PWC use. Due to their similar levels of use, impacts on the South Core Banks at the lighthouse would be similar to those at Shackleford Banks.

Some level of PWC use occurs in the North and South Core Banks from Portsmouth Village to the Lighthouse area, but use is infrequent due to the prevalence of marshes and lack of beaches along the core banks. Because use is infrequent in this area, impacts would be minor, direct, and adverse, similar to those described above, and would be short-term in duration. Areas along Cape Lookout National Seashore where PWC and other watercraft use are minimal are likely to support more wildlife species sensitive to high levels of human activity, especially in areas where there is suitable habitat. Occasional nearshore PWC use in these areas could adversely affect waterfowl or shore birds by disrupting normal nesting, foraging, or resting activities, causing alarm and flight and over time potentially resulting in habitat avoidance and displacement.

In addition to ground-nesting, shorebird and waterfowl species, migratory birds can be affected by noise levels and encroachment associated with PWC use. The *Neotropical Migratory Songbird Coastal Corridor Study* indicates that various songbirds such as hummingbirds, swallows, orioles, tanagers, thrushes, and sparrows are abundant along the mid-Atlantic coastal region, and they are most abundant along the barrier islands. Migratory birds can be easily stressed and are very vulnerable during the intensive migration periods (Mabey et al. 1993). Adverse effects associated with PWC use would be negligible to minor, short-term, adverse impacts, because most migration occurs during times of the year when PWC use is low.

Dolphins and sea turtles could be affected by PWC use either directly from injuries received as a result of collisions, or indirectly through PWC engine noise transmitted underwater. Larval and juvenile stages of many fish and shellfish species inhabiting the shallow protected waters and submerged aquatic vegetation beds where PWC use occurs may be adversely impacted. PWC use in areas providing essential fish habitats for fish and shellfish species could disrupt normal feeding and other critical life functions and could adversely affect suitability of these areas to meet life cycle requirements. Adverse effects to fish and shellfish from PWC emissions, sediment resuspension, and destruction of seagrass beds could also occur. As previously mentioned, the shallow waters of the park generally preclude the high-speed operation of motorized vessels, including PWC. For this reason, adverse impacts on aquatic wildlife from PWC operation are not expected to be severe.

Reinstating PWC use in park waters is expected to have short-term, minor, direct and indirect adverse impacts on aquatic wildlife species and habitats.

Cumulative Impacts. Under alternative A, motorized vessels, including PWC, would have adverse impacts on terrestrial and aquatic wildlife and habitats in park waters, especially in high-use areas. Cumulative impacts would be similar to those under the no-action alternative, but would be somewhat more intense around Shackleford Banks and Lookout Bight where PWC use is common. PWC and other motorized watercraft use would continue to occur throughout park waters and may adversely affect aquatic and terrestrial wildlife species, especially in high boating use areas. Impacts on terrestrial wildlife, specifically birds, and dolphins, fish and shellfish, and their habitats from all motorized vessel use are expected to be short-term, minor, direct and indirect, and adverse.

Short-term, minor, direct and indirect adverse impacts on aquatic wildlife species and habitats are expected under alternative A.

Conclusion. Reinstating PWC use in park waters is expected to have short-term, minor, direct and indirect adverse impacts on terrestrial and aquatic wildlife species and habitats. PWC use in the vicinity of Shackleford Banks and South Core Banks at the lighthouse, where both PWC use and general visitor use is highest, would have minor, short-term, adverse effects on terrestrial wildlife, such as shorebirds, using the landing area and adjacent areas and other species such as fish that using nearshore habitats to forage for food. Effects would be minor because species sensitive to a high level of noise and human activity are not expected to regularly use the landing area or immediately adjacent habitats during periods of high human use.

The intensity of PWC use near the North and South Core Banks from Portsmouth Village to the lighthouse would be much less than near Shackleford Banks and the lighthouse Cumulative impacts associated with an increase in all types of motorized watercraft use are expected to be short-term, minor, direct and indirect, and adverse.

Implementation of this alternative would not result in an impairment of terrestrial or aquatic wildlife or habitats in park waters.

Impacts of Alternative B: Reinstate PWC Use under a Special NPS Regulation with Additional Management Prescriptions (Preferred Alternative)

Analysis. This alternative would establish 10 special use areas to provide PWC access within the Cape Lookout National Seashore boundaries. PWC use would be prohibited in all other areas of the national seashore.

Implementing no-wakes zones in these areas would limit adverse impacts on wildlife within the national seashore boundaries. Impacts of PWC use associated with noise and potential collision impacts with aquatic wildlife would be minimized within national seashore boundaries with the reduction of allowable speeds and adverse noise fluctuations. Negligible, short-term adverse indirect impacts on terrestrial and aquatic wildlife and habitat are expected under alternative B, as noise would be reduced with the implementation of the no-wake zone.

In areas previously open to PWC use that are not within the 10 special use areas, adverse impacts would be eliminated or reduced as PWC noise would be eliminated from these areas and would not create a disturbance to wildlife and wildlife habitats. As PWC operation would be prohibited in park waters outside of the access areas, aquatic wildlife in these areas would not be impacted by PWC use. In the designated access areas, the PWC flat-wake speed requirement and perpendicular approach would not generate waves and would minimize sediment resuspension and damage to seagrass beds. The flat-wake speed limit would further minimize PWC engine noise and fuel emissions to water. Aquatic wildlife

species inhabiting the shallow waters and seagrass beds within the access areas would experience negligible impacts from PWC operation.

Reinstating PWC use in park waters and restricting their operation to a flat-wake perpendicular approach to the shoreline in designated access areas is expected to have short-term, negligible, direct and indirect adverse impacts on aquatic wildlife species and habitats.

Cumulative Impacts. Under alternative B, motorized vessels, including PWC, would have adverse impacts on aquatic wildlife and habitats in park waters, especially in high-use areas such as Shackleford Banks and Lookout Bight. Because non-PWC vessels vastly outnumber PWC in park waters, most cumulative boating impacts on aquatic wildlife would be caused by non-PWC vessels and would be similar to those described under alternative A. Restricting PWC to access areas and flat-wake speed would result in a negligible contribution to cumulative impacts. Cumulative impacts on dolphins, sea turtles, fish and shellfish, and their habitats from all motorized vessel use are expected to be short-term, minor, direct and indirect, and adverse.

Impacts on terrestrial wildlife, specifically birds, from all motorized vessel use are expected to be short-term, negligible to minor, direct and indirect, and adverse. Noise levels and the ability of other motorized watercraft users to access Shackleford Banks and Lookout Bight are expected to adversely affect terrestrial wildlife and shorebirds and waterfowl that may utilize the landing area and adjacent areas by causing alarm or flight responses. Effects are expected to be negligible to minor because these areas have a generally high level of visitation, regardless of PWC usage, and species sensitive to a high level of noise and human activity would probably not regularly use these areas, or immediately adjacent habitats during high use periods.

Conclusion. Alternative B would minimize potential adverse impacts of PWC use in the 10 designated special use areas to negligible to minor, short-term, adverse impacts. The no-wake requirements would reduce the level of PWC disturbance in the restricted areas and in nearby marshes. Reinstating PWC use in park waters and restricting their operation to a flat-wake perpendicular approach to the shoreline in designated access areas is expected to have short-term, negligible to minor, direct and indirect adverse impacts on terrestrial and aquatic wildlife species and habitats.

Cumulative impacts associated with an increase in all types of motorized vessel use are expected to be short-term, negligible to minor, direct and indirect, and adverse.

Implementation of this alternative would not result in an impairment of terrestrial or aquatic wildlife or habitats in park waters.

IMPACT OF PWC NOISE ON AQUATIC FAUNA

Aquatic wildlife react to high levels of underwater noise in various ways, depending on the species, exposure period, intensities, and frequencies. Because of the way PWC are used, noise is usually produced at various intensities, and this continual change in loudness during normal use makes PWC-generated noise much more disturbing than the constant sounds of conventional motorboats (Bluewater Network 2001; Komanoff and Shaw 2000). The sudden increases in noise levels can startle aquatic wildlife, triggering flight responses. In areas of high boating use, the energy cost to aquatic fauna due to noise-induced stresses could be significant, potentially affecting their survival.

Intense sounds can inflict pain and damage the sensory cells of the ears of mammalian species, and there is concern that similar sounds can impair hearing in aquatic wildlife species. One of the few direct studies

on the impact of sound on fishes conducted under laboratory conditions (Hastings et al. 1996) found that when fish were subjected to high decibel levels for four hours, some sensory cells of the ears were damaged. This damage does not show up until a few days after exposure, and it is a short-term effect (regeneration did occur after a few days). Fish exposed to high decibel noise levels may have a short-term disadvantage in detecting predators and prey, potentially adversely affecting their survival. In addition, several species of fish in the drum family produce sounds as part of their mating behavior, so short-term hearing damage could negatively affect reproduction. Loggerhead turtle nesting has been shown to be negatively affected by loud noises such as close overflights by aircraft (EuroTurtle 2001), but it is unknown at what frequencies and intensity noise might affect sea turtles or damage their hearing.

Although marine mammals show a diverse behavioral range that can obscure correlations between a specific behavior and the impact from noise, experts from around the country have voiced concern that PWC activity can have negative impacts on marine mammals, disturbing normal rest, feeding, social interactions, and causing flight (Getten 1995; HDNR 1995; SJC 1998; Osborne 1998). Toothed whales (including dolphins), produce sounds across a broad range of frequencies for communication as well as echolocation, a process of creating an acoustic picture of their surroundings for the purpose of hunting and navigation. Watercraft engine noise can mask sounds that these animals might otherwise hear and use for critical life functions and can cause temporary hearing threshold shifts. Bottlenose dolphins exposed to less than an hour of continuous noise at 96 dB experienced a hearing threshold shift of 12 to 18 dB, which lasted hours after the noise terminated (Au et al. 1999). A hearing threshold shift of this degree would substantially reduce a dolphin's echolocation and communication abilities. Perry (1998) reviewed numerous scientific studies documenting increased swimming speed, avoidance, and increased respiration rates in whales and dolphins as a result of motorized watercraft noise. Whales have been observed to avoid man-made noise of 115 dB, and at higher frequencies, whales become frantic, their heart rates increase, and vocalization may cease (CCU 1998).

Bottlenose dolphins and manatees may be present in the waters surrounding Cape Lookout National Seashore in the summer months and could be affected by PWC-generated noise. Kemp's ridley, loggerhead, leatherback, and green sea turtles occur in the waters around Cape Lookout National Seashore, and three of these species have nested on park beaches (NPS 2003). In addition, more than 200 species of fish probably occur in the waters surrounding Cape Lookout National Seashore. Essential fish habitat occurs in the vicinity of Cape Lookout for a number of commercially and recreationally important fish (refer to the "Aquatic Wildlife" section in the "Affected Environment" chapter).

METHODOLOGY AND ASSUMPTIONS

Noise generated by motorized watercraft can exceed 100 dB over a range of frequencies from 12 Hz to 30 kHz (CCU 1998). Bottlenose dolphins produce whistles at sound levels of 125 to 173 dB (URI 2003) at frequencies of 4 to 20 kHz (Buckstaff 2003). Because the measurement scales for sound in water and in air have a difference of about 60 dB between them (NOAA n.d.), a PWC producing 80 dB in air would produce approximately 140 dB underwater. As dolphin communication occurs within the frequencies and intensities of motorized watercraft, engine noise generated by PWC and motorboats could impede the ability of dolphins to communicate, navigate, or hunt, and could displace them from preferred feeding habitats. Turtles and fish also rely on hearing for critical life functions and could be similarly affected.

Because sound dissipates over distance, the noise levels heard by a marine animal decrease as the distance to the source increases. Characteristics of the waterbody affect the way sound waves attenuate as they travel through the water. Shallow waters such as Back and Core Sounds do not favor the propagation of underwater sound waves. Objects in the water such as vegetation can absorb sound wave energy. Upon reaching the seabed and the sea surface, sound waves scatter in all directions.

There are no data for PWC-related noise effects on marine mammals, reptiles, or fish, and no specific monitoring has been done at the national seashore to quantify impacts. Therefore, personal observations of park staff were used to determine areas of concern. These areas were identified and assessed relative to the number, location, and season of use, of PWC and the species present in those sensitive areas. The same magnitude of effects and impact analysis area as defined for the "Wildlife and Wildlife Habitat" section were used to assess PWC underwater noise impacts.

Impacts of the No-Action Alternative: Continue Prohibition of PWC Use in Cape Lookout National Seashore

Analysis. Under this alternative, PWC use would continue to be prohibited in all jurisdictional waters of Cape Lookout National Seashore. Because PWC use would not be allowed in park waters, aquatic fauna would not be subjected to high levels of PWC noise at close range and there would be no adverse impacts from PWC operating within park waters.

Cumulative Impacts. There is considerable boating activity in and around Cape Lookout National Seashore. As a result, human activity and noise levels are typically high in many area of the park, especially between May and September. Underwater noise sources include motorboats, commercial vessels, and official vessels (U.S. Coast Guard, police, military). Because PWC use would be prohibited within park waters under this alternative, they would not contribute to cumulative noise levels produced in park waters.

Non-PWC motorized vessel use would still occur throughout park waters and could adversely affect aquatic wildlife species, especially in areas experiencing high recreational boating use, such as Shackleford Banks and Lookout Bight. Motorized vessels would generate underwater engine noise in shallow waters and submerged aquatic vegetation beds that are critical to many species of fish and shellfish. Dolphins and sea turtles would also be exposed to engine noise from motorized vessels. However, because waters under the park's jurisdiction are quite shallow, motorized vessels generally travel quite slowly within park waters, so overall sound impacts would not be severe. Additionally, the shallow waters of the park and the submerged aquatic vegetation beds they contain would reduce the propagation of underwater engine noise, causing sound waves to rapidly attenuate. Because peak boating activity occurs during the middle of the day and primarily on weekends, and only on a seasonal basis, noise impacts on aquatic fauna are not expected to be long-term. New technologies would also contribute to reduced noise emissions from recreational marine engines in the future (Sea-Doo 2001a). Impacts on aquatic fauna from motorized vessel noise under the no-action alternative are expected to be adverse, minor, and short-term.

Conclusion. Continuing the prohibition on PWC use within park waters would eliminate adverse impacts from PWC within park boundaries.

Impacts on aquatic fauna in park waters from non-PWC motorized vessels noise under the no-action alternative would be expected to be adverse, minor, and short-term.

Implementation of this alternative would not result in an impairment of aquatic fauna.

Impacts of Alternative A: Reinstate PWC Use under a Special NPS Regulation as Previously Managed

Analysis. Under alternative A, PWC use would be reinstated in all park waters as previously managed under the *Cape Lookout National Seashore: Superintendent's Compendium* (NPS 2003b), and all state regulatory requirements would apply. PWC use would occur throughout the national seashore, producing underwater noise in aquatic habitats which support numerous fish and shellfish species. Dolphins and sea turtles would also be exposed to PWC engine noise, particularly in high-use areas. Several PWC operating at flat-wake speed and in close proximity to each other could produce underwater noise levels as high as 130 dBA. PWC-generated underwater noise levels would be more intense in the high-use areas of Shackleford Banks and Lookout Bight. However, the combination of shallow waters and the prevalence of submerged aquatic vegetation beds would rapidly cause sound waves to attenuate. In addition, the slow speeds PWC travel at while approaching the park would minimize engine noise production. As PWC trips are of short duration and their operation is highly seasonal, impacts are not expected to be long-term.

Reinstating PWC use in the national seashore is expected to have short-term, minor, adverse impacts on aquatic fauna.

Cumulative Impacts. Under alternative A, motorized vessels, including PWC, would be able to access park waters, producing significant levels of underwater noise, especially in high PWC and boating use areas. As PWC are outnumbered by other motorboats in the park by more than 10 to 1, most cumulative noise impacts would be attributed to non-PWC vessels. Cumulative impacts would be similar to those under the no-action alternative, but would be somewhat more intense in areas where PWC use tends to become focused, such as Shackleford Banks and Lookout Bight. The levels of underwater noise produced by PWC and boating activity in these high-use areas could affect critical life functions of aquatic fauna and the suitability of their habitats. However, PWC and boating speeds in park waters are slow, and the trip durations are short. Additionally, the characteristics of park waters do not favor the propagation of sound waves, and PWC and boating activity are limited to daytime hours and the warmer months. Impacts on aquatic fauna are expected to be short-term, minor, and adverse.

Conclusion. Reinstating PWC use in park waters would be expected to have short-term, minor, adverse impacts on aquatic fauna due to noise.

Implementation of this alternative would not result in an impairment of aquatic fauna.

Impacts of Alternative B: Reinstate PWC Use under a Special NPS Regulation with Additional Management Prescriptions (Preferred Alternative)

Analysis. Under alternative B, PWC use would be allowed within 10 designated access areas, as identified in the "Alternatives" chapter. PWC operation within these access areas would be restricted to a perpendicular approach to the shoreline at flat-wake speed. PWC operation would be prohibited in park waters outside of the access areas. All state regulatory requirements would continue to apply.

PWC would be prohibited from operating in most park waters in Back and Core Sounds. PWC operating in the designated access areas would produce underwater noise at levels that would be detectable by aquatic wildlife; however, PWC would be traveling at slow speeds and producing relatively little noise. The shallow, vegetated waters of the park would further reduce noise levels which aquatic wildlife would be exposed to. Aquatic wildlife inhabiting salt marshes and submerged aquatic vegetation beds in the

vicinity of the PWC access areas would be exposed to relatively low levels of PWC engine noise, while waters in most areas of the park would not be affected by PWC engine noise.

Reinstating PWC use in park waters and restricting their operation to a flat-wake perpendicular approach to the shoreline in designated access areas is expected to have short-term, negligible, adverse impacts on aquatic wildlife species and habitats.

Cumulative Impacts. Under alternative B, PWC would be prohibited from most park waters, while other motorized watercraft would have access to all park waters. Because non-PWC vastly outnumber PWC, most noise production would be attributed to non-PWC vessels. Aquatic fauna inhabiting salt marsh and submerged aquatic vegetation habitats in Back and Core Sounds would be exposed to underwater noise generated by non-PWC vessels. However, PWC and boating speeds in park waters are slow, and the trip durations are short. Additionally, the characteristics of park waters do not favor the propagation of sound waves, and PWC and boating activity are limited to daytime hours and the warmer months.

Under alternative B, impacts on aquatic fauna are expected to be short-term, negligible to minor, and adverse.

Conclusion. Reinstating PWC use in park waters and restricting their operation to a flat-wake perpendicular approach to the shoreline in designated access areas is expected to have short-term, negligible, adverse impacts on aquatic fauna.

Implementation of this alternative would not result in an impairment of aquatic fauna.

THREATENED, ENDANGERED, OR SPECIAL CONCERN SPECIES

GUIDING REGULATIONS AND POLICIES

The *Endangered Species Act* (16 USC 1531 et seq.) mandates that all federal agencies consider the potential effects of their actions on species listed as threatened or endangered. If the NPS determines that an action may adversely affect a federally listed species, consultation with the U.S. Fish and Wildlife Service is required to ensure that the action will not jeopardize the species' continued existence or result in the destruction or adverse modification of critical habitat. Informal consultation was initiated with the U.S. Fish and Wildlife Service during the internal scoping period for this project. A list of species that are known to occur or may occur within or adjacent to PWC activity within the boundaries of Cape Lookout National Seashore was requested. The response from the U.S. Fish and Wildlife Service is included in appendix B. [Response has not yet been received.]

At Cape Lookout National Seashore it has been determined that none of the alternatives are likely to adversely affect any of the listed species. The completed environmental assessment will be submitted to the U.S. Fish and Wildlife Service for its review. If the agency concurs with the finding of the NPS, no further consultation will be required.

Formal consultation would be initiated if the NPS determines that actions associated with the preferred alternative are likely to adversely affect one or more of the federally listed threatened or endangered species identified in the national seashore. At that point a biological assessment would be prepared to document the potential effects. From the date that formal consultation was initiated, the U.S. Fish and Wildlife Service would be allowed 90 days to consult with the agency and 45 days to prepare a biological opinion based on the biological assessment and other scientific sources. The U.S. Fish and Wildlife Service would state its opinion as to whether the proposed PWC activities would be likely to jeopardize

the continued existence of the listed species or to result in the destruction or adverse modification of critical habitat. Such an opinion would be the same as a determination of impairment. To ensure that a species was not be jeopardized by PWC activities, the NPS would confer with the U.S. Fish and Wildlife Service to identify recommendations for reducing adverse effects and would integrate those into the preferred alternative (alternative B).

NPS Management Policies 2001 [NPS 2001d] state that potential effects of agency actions will also be considered on state or locally listed species. The NPS is required to control access to critical habitat of such species, and to perpetuate the natural distribution and abundance of these species and the ecosystems upon which they depend.

The species at Cape Lookout National Seashore that have the potential to be affected by proposed PWC management alternatives include species that are known to inhabit or are likely to inhabit the area, plus those that could possibly be found in the area, but would most likely be transients or migrants.

METHODOLOGIES AND ASSUMPTIONS

Identification of state and federally listed species was accomplished through discussions with park staff, and informal consultation with U.S. Fish and Wildlife Service and the National Marine Fisheries Service. Response letters from the above referenced agencies are included in appendix B. Primary steps in assessing impacts on listed species were to determine (1) which species are found in areas likely to be affected by management actions described in the PWC alternatives, (2) current and future use and distribution of PWC by alternative, (3) habitat loss or alteration caused by the alternatives, and (4) displacement and disturbance potential of the actions and the species' potential to be affected by PWC activities. The information contained in this analysis was obtained through best professional judgment of park staff and experts in the field (as cited in the text), and by conducting literature review.

Documentation of the occurrence and locations of federal and state rare, threatened and endangered species on Cape Lookout National Seashore was provided by NPS through several studies and surveys that have been conducted at the park. Determination of the potential for adverse effects to rare threatened and endangered species was based on the locations of sensitive species with respect to PWC use and the potential for the use to affect the species. All known federally listed species that occur on the Cape Lookout National Seashore are discussed in the analysis. Only state listed species that occur in the vicinity of the PWC use areas, or that have potential to be affected by PWC use, are discussed in the analysis.

IMPACT OF PWC USE ON THREATENED, ENDANGERED, AND SPECIAL CONCERN SPECIES

The *Endangered Species Act* defines the terminology used to assess impacts on listed species as follows:

> *No effect:* A proposed action would not affect a listed species or designated critical habitat.
>
> *May affect / not likely to adversely affect:* Effects on special concern species would be discountable (i.e., extremely unlikely to occur and not able to be meaningfully measured, detected, or evaluated) or completely beneficial.
>
> *May affect / likely to adversely affect:* When an adverse effect to a listed species might occur as a direct or indirect result of proposed actions and the effect would either not be discountable or completely beneficial.

Is likely to jeopardize proposed species/adversely modify proposed critical habitat): The appropriate conclusion when the NPS or the U.S. Fish and Wildlife Service identify situations in which PWC use could jeopardize the continued existence of a proposed species or adversely modify critical habitat to a species within and/or outside the park boundaries.

Impairment: For the purposes of this analysis, those effects likely to jeopardize proposed species/adversely modify proposed critical habitat would have the potential to impair park resources. At this level, the integrity of park resources would substantially affect natural systems and the ability of future generations to enjoy the resource.

Impacts of the No-Action Alternative: Continue Prohibition of PWC Use in Cape Lookout National Seashore

Analysis. Under this alternative, PWC operation would continue to be prohibited in all jurisdictional waters of Cape Lookout National Seashore. Because PWC use would not be allowed in park waters, they would not affect aquatic threatened, endangered or special concern species in park waters. No effects to terrestrial threatened or endangered species from PWC use are expected under the no-action alternative.

Cumulative Impacts. PWC use would not contribute to cumulative impacts on aquatic threatened or endangered species in park waters. Non-PWC motorized vessel use would still occur within park waters and may adversely affect some special concern species through collisions, noise impacts, and water quality impacts. Non-PWC use is unlikely to affect manatees because they are uncommon in Back and Core Sounds and have not been observed in the park's jurisdictional waters. Likewise, non-PWC use is unlikely to affect northern right whales and humpback whales, as these species are not usually present in park waters during the warmer months when boating use is high. Sea turtles and Carolina diamondback terrapins are likely to occur in park waters. However, because boating speeds are slow, due to the shallow waters of the park, and trip lengths are short, impacts on sea turtles and terrapins are expected to be minor.

PWC and non-PWC vessel use may affect but is not likely to adversely affect aquatic or terrestrial species of special concern as other motorized watercraft would have access to the park but typically do not frequent areas where species of concern are present.

Conclusion. Continuing the prohibition on PWC use within Cape Lookout National Seashore would ensure that special concern species are not affected by PWC use within park waters. Other motorized watercraft may affect but are not likely to adversely affect these species in park waters because of the slow travel speeds and short trip lengths and location of use.

Implementation of this alternative would not result in an impairment of terrestrial or aquatic threatened, endangered, or special concern species in park waters.

Impacts of Alternative A: Reinstate PWC Use under a Special NPS Regulation as Previously Managed

Analysis. Under alternative A, PWC use would be reinstated in all waters within Cape Lookout National Seashore as previously managed under the *Cape Lookout National Seashore: Superintendent's Compendium* (NPS 2003b), and all state regulatory requirements would apply. PWC use would occur throughout park waters, particularly in the high-use areas around Shackleford Banks and in Lookout Bight. PWC use may affect but is not likely to adversely affect manatees because they are uncommon in

Back and Core Sounds and have not been observed in the park's jurisdictional waters. PWC would not affect fin and sperm whales because they are not known to occur live in park waters. PWC use may affect but is not likely to adversely affect northern right whales and humpback whales, as these species are not likely to be present in park waters during the warmer months when PWC use is high. The four species of threatened and endangered sea turtles and the Carolina diamondback terrapin are likely to occur within shallow waters in Back and Core Sounds during the summer. As PWC operation in park waters would consist of slow speeds and short trip durations, PWC engine noise production and fuel emissions to park waters would be low. Because of this, the potential for collisions with turtles within park waters also would be low. PWC use may affect but is not likely to adversely affect these turtle species through collisions or noise or water quality impacts.

The majority of piping plover nests are located on North Core Banks, which accounted for 10 out of 14 nesting pairs in 2003. The majority of PWC activity occurs at Shackelford Banks and the lighthouse in the South Core Banks. Sea beach amaranth, piping plover nesting areas, and gull-billed tern nesting areas are all roped off where present. These species generally occur in areas of low PWC use, and PWC use may affect but is not likely to adversely affect these species.

Cumulative Impacts. Motorized vessels, including PWC would be operated throughout park waters under this alternative and may impact aquatic special concern species. As mentioned above, manatees are not common in the area and northern right whales and humpback whales are not likely to occur in park waters in the summer, so PWC and other motorized watercraft use may affect but is not likely to adversely affect these species. Trip lengths for PWC and non-PWC are short, and due to the park's very shallow waters, operation of these vessels primarily consists of slow speed travel. Because of these factors, PWC and non-PWC vessel use may affect but is not likely to adversely affect sea turtles or Carolina diamondback terrapins. Non-PWC outnumber PWC in park waters by more than 10 to 1, so any motorized vessel impacts on special concern species would be attributed predominantly to non-PWC.

Due to the location of sensitive species and the areas of high PWC use and other motorized watercraft being typically separate, PWC use and other motorized watercraft may affect but is not likely to adversely affect special concern species.

Conclusion. Reinstating PWC use within Cape Lookout National Seashore may affect but is not likely to adversely affect manatees or whales in park waters, as these species are not present in areas or during seasons of peak PWC use. PWC and other motorized vessel use may affect but is not likely to adversely affect sea turtles, Carolina diamondback terrapins, or special concern birds because of the slow vessel speeds and short trip lengths.

Implementation of this alternative would not result in an impairment of terrestrial or aquatic threatened, endangered, or special concern species in park waters.

Impacts of Alternative B: Reinstate PWC Use under a Special NPS Regulation with Additional Management Prescriptions (Preferred Alternative)

Analysis. Under alternative B, PWC use would be allowed within ten designated access areas, as identified in the "Alternatives" chapter. PWC operation within these access areas would be restricted to a perpendicular approach to the shoreline at flat-wake speed. PWC operation would be prohibited in park waters outside of the access areas. All state regulatory requirements would continue to apply.

Alternative B may affect, but is not likely to adversely affect, federally listed threatened or endangered terrestrial species in the Cape Lookout National Seashore. Effects to federally listed threatened or

endangered species associated with PWC use under alternative B would be similar to those discussed under alternative A. However, the potential for impacts would be further minimized due to reduced levels of activity and use. Enforcement of no-wake zones in the ten designated special use areas would decrease potential for nearshore noise associated with the PWC use to adversely affect protected species such as the piping plover.

As PWC operation would be prohibited in park waters outside of the access areas, aquatic special concern species in these areas would not be impacted by PWC use. As previously mentioned, manatees and whales are not likely to be present in park waters during the summer when PWC use is high. Sea turtles and the Carolina diamondback terrapin are likely to be present in park waters during the summer. These turtles may be affected but are not likely to be adversely affected by PWC use under this alternative, because most park waters would be off-limits to PWC and because the flat-wake speed restriction would further reduce the potential for collision, as well as reducing engine noise production and fuel discharge to water.

Reinstating PWC use in park waters and restricting their operation to a flat-wake perpendicular approach to the shoreline in designated access areas may affect but is not likely to adversely affect aquatic special concern species.

The majority of piping plover nests are located on North Core Banks, which accounted for 10 out of 14 nesting pairs in 2003. The majority of PWC activity occurs at Shackelford Banks and the lighthouse in the South Core Banks. Sea beach amaranth, piping plover nesting areas, and gull-billed tern nesting areas are all roped off where present. These species generally occur in areas of low PWC use, and PWC use may affect but is not likely to adversely affect these species.

Cumulative Impacts. Under alternative B, PWC use would be limited to flat-wake speed within designated access areas, resulting in a negligible contribution to cumulative impacts. Non-PWC motorized vessels would be able to operate throughout park waters. Because manatees are not common in the area and northern right whales and humpback whales are not likely to occur in park waters in the summer, PWC and other motorized watercraft use may affect but is not likely to adversely affect these species. As previously mentioned, trip lengths for PWC and non-PWC are short, and due to the park's very shallow waters, operation of these vessels primarily consists of slow speed operation. Because of these factors, PWC and non-PWC vessel use may affect but is not likely to adversely affect sea turtles or Carolina diamondback terrapins. Non-PWC outnumber PWC in park waters by more than 10 to 1, so any motorized vessel impacts on special concern species would be predominantly attributed to non-PWC.

Due to the location of sensitive species and the areas of high PWC use and other motorized watercraft being typically separate, PWC use and other motorized watercraft may affect but is not likely to adversely affect special concern species.

Conclusion. Reinstating PWC use in park waters and restricting their operation to a flat-wake perpendicular approach to the shoreline in designated access areas may affect but is not likely to adversely affect manatees or whales in park waters, as these species are not present in areas or during seasons of peak PWC use. PWC and other motorized vessel use may affect but is not likely to adversely affect sea turtles or Carolina diamondback terrapins because of the slow vessel speeds and short trip lengths.

Implementation of this alternative would not result in an impairment of aquatic special concern species in park waters.

VISITOR USE AND EXPERIENCE

Some research suggests that PWC use is viewed by some segments of the public as a nuisance due to their noise, speed, and overall environmental effects, while others believe that PWC are no different from other motorcraft and that people have a right to enjoy the sport. The primary concern involves changes in noise, pitch, and volume due to the way PWC are operated. Additionally, the sound of any watercraft can carry for long distances, especially on a calm day.

GUIDING REGULATIONS AND POLICIES

NPS Management Policies 2001 [NPS 2001d] state that the enjoyment of park resources and values by the people of the United States is part of the fundamental purpose of all parks and that the NPS is committed to providing appropriate, high-quality opportunities for visitors to enjoy the parks. Because many forms of recreation can take place outside a national park setting, the NPS will therefore seek to

- provide opportunities for forms of enjoyment that are uniquely suited and appropriate to the superlative natural and cultural resources found in a particular unit

- defer to local, state, and other federal agencies; private industry; and non-governmental organizations to meet the broader spectrum of recreational needs and demands that are not dependent on a national park setting

Unless mandated by statute, the NPS will not allow visitors to conduct activities that

- would impair park resources or values;

- would create an unsafe or unhealthful environment for other visitors or employees;

- are contrary to the purposes for which the park was established; or

- would unreasonably interfere with the atmosphere of peace and tranquility, or the natural soundscape maintained in wilderness and natural, historic, or commemorative locations within the park; NPS interpretive, visitor service, administrative, or other activities; NPS concessionaire or contractor operations or services; or other existing, appropriate park uses.

Cape Lookout's original enabling legislation authorized that Cape Lookout National Seashore be established "to preserve for public use and enjoyment an area in the state of North Carolina possessing outstanding natural and recreational values." Additionally, the secretary was directed to "administer the Cape Lookout National Seashore for the general purposes of public outdoor recreation, including conservation of natural features contributing to public enjoyment." One of the national seashore's management objectives is "to make the seashore resources available and islands accessible to visitors, on foot or in vehicles, but with a limited impact on the environment, and to interpret the seashore with primary emphasis on the effects of the sea on the barrier islands" (*1982 General Management Plan* [NPS 1982]).

METHODOLOGIES AND ASSUMPTIONS

The purpose of this impact analysis was to determine if PWC use at Cape Lookout National Seashore is compatible or in conflict with the purpose of the park, its visitor experience goals, and the direction

provided by *NPS Management Policies 2001* [NPS 2001d]. Thus, these policies and goals were integrated into the impact thresholds.

To determine impacts, the current level of PWC use (based on current high-use days) was calculated for segments of the national seashore (see the "PWC and Boating Use Trends" section). Other recreational activities and visitor experiences that are proposed in these locations were also identified. Visitor surveys and staff observations were evaluated to determine visitor attitudes and satisfaction in areas where PWC are used. According to the Texas A&M survey conducted in 1993, over 70% of national seashore visitors rated their trip as "excellent" or "very good," indicating a high overall visitor satisfaction.

The potential for change in visitor experience was evaluated by identifying projected increases or decreases in both PWC and other visitor uses, and determining whether these projected changes would affect the desired visitor experience and result in greater safety concerns or additional user conflicts.

IMPACT ANALYSIS AREA

In terms of PWC use, the appropriate boundary for analyzing visitor experience impacts includes those areas within Cape Lookout National Seashore's jurisdiction that are currently open to vessels as described in the *Cape Lookout National Seashore: Superintendent's Compendium* (NPS 2003b) as well as those areas that would be open to PWC use under the proposed alternatives. Additionally, PWC use may affect visitors swimming and camping near the shoreline, such that visitors within 200 feet of the shore are considered to be within the affected area.

IMPACT OF PERSONAL WATERCRAFT ON VISITOR EXPERIENCE GOALS

The following thresholds for evaluating impacts on visitor experience were defined:

Negligible: Visitors would not likely be aware of the effects associated with changes proposed for visitor use and enjoyment of park resources.

Minor: Visitors would likely be aware of the effects associated with changes proposed for visitor use and enjoyment of park resources; however the changes in visitor use and experience would be slight and likely short-term. Other areas in the park would remain available for similar visitor experience and use without derogation of park resources and values.

Moderate: Visitors would be aware of the effects associated with changes proposed for visitor use and enjoyment of park resources. Changes in visitor use and experience would be readily apparent and likely long-term. Other areas in the park would remain available for similar visitor experience and use without derogation of park resources and values, but visitor satisfaction might be measurably affected (visitors could be either satisfied or dissatisfied). Some visitors who desire to continue their use and enjoyment of the activity/visitor experience would be required to pursue their choice in other available local or regional areas.

Major: Visitors would be highly aware of the effects associated with changes proposed for visitor use and enjoyment of park resources. Changes in visitor use and experience would be readily apparent and long-term. The change in visitor use and experience proposed in the alternative would preclude future generations of some visitors from enjoying park resources and values. Some visitors who desire to continue their use and enjoyment of the activity / visitor experience would be required to pursue their choice in other available local or regional areas.

Impacts of the No-Action Alternative: Continue Prohibition of PWC Use in Cape Lookout National Seashore

Analysis. Under the no-action alternative, PWC would continue to be banned at Cape Lookout National Seashore.

Impacts on PWC Users – Because PWC were banned at Cape Lookout National Seashore in 2002, continuation of the ban would result in no impacts on PWC users, who are already prohibited from operating at the national seashore. PWC users who use their watercraft primarily for transportation to and from the islands could continue to access the national seashore using one of the many ferry services, or by private boat. Those visitors who own and want to continue using a PWC would have to recreate in other locations. However, the soundside waters beyond the national seashore's jurisdiction, which is 150 feet from mean low tide and constitutes only a narrow corridor along the islands, would remain open to PWC use. A PWC ban would not extend beyond the park's jurisdiction. In addition, as of April 12, 2002, comments received by the national seashore regarding banning PWC indicated that only 5% were in favor of permitting PWC use at Cape Lookout (NPS 2003c). Park staff have estimated that 99% of all visitors arrive by means other than PWC. These figures indicate that few national seashore visitors would be impacted by continuation of the ban.

Impacts on Other Boaters – Other boaters, including motorized boat users and nonmotorized users, would also experience no impacts of continuation of the ban, which has been in place since 2002. Users of nonmotorized boats, such as sailboats, kayaks, and canoes, would be more affected by motorized noise and wakes from other vessels; kayakers have complained about PWC use in the past and would not experience adverse impacts from interaction with PWC.

Impacts on Other Non-PWC Users – Non-PWC users would also experience no impacts from continuation of the PWC ban. There would be no impacts on wilderness values on Shackleford Banks.

Cumulative Impacts. Because the national seashore's islands can only be accessed by boat, other motorized boating activities would continue to contribute adverse impacts, particularly to wilderness values and those visitors seeking calm, quiet waters, such as anglers and kayakers. Visitation to the Cape Lookout area is expected to increase substantially when the national seashore opens the lighthouse to the public in 2005, increasing the amount of motorized vessels in this area. While access to the lighthouse will benefit visitors, increased congestion in an already busy inlet could have an adverse affect.

Overall cumulative impacts would be adverse, short-term, and moderate due to continued and expected increased use of motorized boats.

Conclusion. Implementation of the PWC ban would have no impacts on PWC or other national seashore users because the ban has been in place since 2002. Therefore, there would be no change to visitor experience. Cumulative impacts would be adverse, short-term, and moderate due to continued and increased use of motorized boats.

Impacts of Alternative A: Reinstate PWC Use under a Special NPS Regulation as Previously Managed

Analysis. PWC operators under alternative A would have unrestricted use within Cape Lookout National Seashore, increasing from an average high use of 36 PWC on a peak day in 2003 to 48 by 2013 in the popular Shackleford Banks area. PWC use is expected to increase from 21 to 28 in the lighthouse area, and from 3 to 4 in the North Core Banks area.

Impacts on PWC Users – PWC users would experience beneficial, long-term impacts by reinstatement of PWC use throughout the national seashore. However, PWC users represent only 1% of all visitors to Cape Lookout, so very few visitors would be affected.

Impacts on Other Boaters – Other boaters at Cape Lookout National Seashore would interact with PWC operators; nonmotorized boaters, such as sailboats, kayaks, and canoes, would be most affected due to the noise, high speeds, and maneuverability associated with PWC, resulting in adverse impacts. Canoes and kayaks that frequent the marshlands in along the Core Banks would be impacted the least because PWC use in this area, particularly marshlands, has been historically infrequent. Boaters seeking solitude in the national seashore's northern reaches would experience no or negligible impacts, since few, if any, PWC frequented this area in the past. Paddlers and motorboat operators traveling to the west end of Shackleford or the Cape Lookout lighthouse and Cape Lookout Bight area would experience the most adverse impacts. Other motorized boat users would also interact with PWC, and may experience adverse impacts for similar reasons. However, motorized boat users may find PWC use more compatible with their type of recreation, and experience impacts of reduced intensity.

Impacts on Other Non-PWC Users – Other non-PWC users would experience adverse impacts from reinstatement of PWC, particularly swimmers and beachcombers who would be disrupted by the noise and disturbance caused by additional motorcraft. Surfers and anglers using the oceanside of the national seashore would experience few, if any, impacts, since PWC have historically avoided ocean surf. Campers at Wade's Shore and the lighthouse area would also be adversely affected by noise and disturbance, although PWC would not be permitted to operate after sunset, when solitude would be most expected. Campers near Portsmouth Village would experience little or no impacts, as few PWC visited this area in the past. PWC would adversely affect wilderness values on the soundside of Shackleford Banks.

As noted under the no-action alternative, most non-fishing visitors come to the national seashore seeking a remote beach experience. In addition, 89% of respondents during public scoping for this EA indicated that they were in favor of banning PWC from the national seashore. Therefore, a majority of visitors may perceive PWC use as incompatible with their experience at Cape Lookout National Seashore. However, PWC users represented only 1% of all visitors, so adverse effects may be offset by this low amount of use.

Short-term impacts on all visitors would occur depending on the duration of exposure to PWC during a given visit. Visitors would also experience long-term impacts in that PWC would be permitted to access the national seashore indefinitely into the future.

Cumulative Impacts. As described under the no-action alternative, a substantial visitation increase is expected starting in about 2005 with the potential opening of the Cape Lookout lighthouse to the public. This would result in more boat congestion in Barden Inlet, which is already very crowded with boaters accessing this area. Combining reinstated PWC use with an increase in other motorized boat use throughout the national seashore would result in an adverse impact. Despite the fact that only 1% of visitors used PWC to access the national seashore in the past, impact levels would be moderate due to expected substantial increases in visitation.

Hunting on Shackleford Banks could adversely affect wilderness values there if combined with noise and disturbance from PWC use. However, hunting season typically occurs during fall and winter, when overall visitation and PWC use is lower.

Conclusion. Reinstating PWC use at Cape Lookout National Seashore would result in beneficial impacts on PWC users, but adverse, short- and long-term impacts on most nonmotorized boat users. Other boaters

would also experience adverse impacts of lesser intensity if they perceive PWC use as a compatible boating alternative. Impacts would range from negligible to moderate depending on location. Cumulative impacts would be adverse, short- and long-term, and moderate due to expected increases in visitation.

Impacts of Alternative B: Reinstate PWC Use under a Special NPS Regulation with Additional Management Prescriptions (Preferred Alternative)

Analysis. Under alternative B, PWC would have access to 10 areas distributed along the entire national seashore. These areas include those that were historically popular with PWC users, such as the Cape Lookout cove area and the west end of Shackleford Banks. Fifty-one miles of the seashore's soundside and 56 miles of the oceanside would be closed to PWC use. Five of a total of 10 miles (50%) of soundside sandy beaches would be available to PWC use.

Impacts on PWC Users – PWC users would experience beneficial impacts, as they would have access to those areas that were historically popular with PWC riders. PWC would be restricted from the marshlands along the Core Banks, which they avoided anyway for practical reasons. With the exception of the restricted area between the two toilet facilities on Shackleford Banks, PWC would have access to the areas frequented by PWC prior to the ban. Therefore, benefits would be similar to having access to the entire national seashore, with the exception of the restricted area on Shackleford. Impacts would be beneficial, long-term, and minor since approximately only 1% of all visitors would be affected.

Impacts on Other Boaters – PWC would return to popular areas such as the Cape Lookout lighthouse area and Shackleford Banks, with the exception of the restricted section there. Under alternative B, PWC users would be required to operate at flat-wake speed within park waters, providing a beneficial impact to all boaters, particularly kayakers and canoeists, who would be most affected by wakes and noise. Canoeists and kayakers paddling the marshlands along the Core Sound would experience negligible impacts from reinstated PWC use because PWC would be prohibited in marshland areas. Although some complaints have been submitted regarding PWC use in these areas, PWC have primarily avoided marshlands in the past. Boaters in the national seashore's northern reaches would experience few, if any, impacts, given the extremely low PWC use in this area in the past. Paddlers and motor boat operators using the west end of Shackleford near Beaufort Inlet or the Cape Lookout lighthouse area would experience the most adverse impacts due to congestion in these popular areas. Other motorized boat users would also interact with PWC, and may experience adverse impacts for similar reasons. However, as described under alternative A, motorized boat users may find PWC use more compatible with their type of recreation. Depending on location, overall impacts on other boaters would be adverse, short- and long-term, and negligible to minor due to flat-wake PWC speed restrictions in park waters.

Impacts on Other Non-PWC Users –As with other boaters, other non-PWC users would experience benefits from flat-wake speed restrictions under alternative B. The PWC restricted area along Shackleford Banks between the two toilet facilities would provide beneficial impacts on visitors in this area. A stretch of maritime forest fronts the sound in this restricted area, providing a natural, pristine wilderness setting that is popular with campers (Wade's Shore is located near the eastern toilet facility on Shackleford). Restricting PWC in this area would enhance wilderness values there, including preservation of the primeval character of the wilderness, natural conditions (including lack of man-made noise), outstanding opportunities for solitude, and a primitive recreational experience. Because most non-fishing visitors come to the national seashore seeking a remote beach experience, restricted PWC use under this alternative would provide a beneficial impact to these visitors. In addition, 89% of respondents during public scoping indicated that they were in favor of banning PWC from the national seashore. Therefore, a majority of visitors may perceive PWC use as incompatible with their experience at Cape Lookout

National Seashore and would prefer restricted access, even though PWC represented only a small percentage of national seashore visitors.

Restricting PWC within national seashore waters to flat-wake speed would also be particularly beneficial to swimmers, anglers, and beach combers, who may be more likely to experience adverse impacts from PWC use than motorized boat users.

Short-term impacts on all visitors would occur depending on the duration of exposure to PWC during a given visit. Visitors would also experience long-term impacts in that PWC use would have restricted access to the national seashore indefinitely into the future.

Cumulative Impacts. Cumulative impacts would be similar to those described under alternative A regarding an increase in motorized boaters accessing the Cape Lookout lighthouse starting in 2005. However, flat-wake speed restrictions under this alternative would provide a benefit in areas of increasing congestion. An increase in boaters in Barden Inlet, combined with restricted, reinstated PWC use, would result in an adverse impact in this area. Combining restricted PWC use with other motorized boat use would result in an adverse impact. Even though only 1% of visitors used PWC to access the national seashore in the past, impact levels would be moderate due to expected increases in visitation.

Conclusion. Reinstating PWC use with restricted access would result in beneficial impacts on PWC users, but adverse, short- and long-term impacts on other boaters (motorized and nonmotorized) ranging from negligible to moderate depending on location and type of boat use. Cumulative impacts would be adverse, short- and long-term, and negligible due to the historically low numbers of PWC at the national seashore and additional PWC use restrictions.

VISITOR CONFLICTS AND SAFETY

Industry representatives report that PWC accidents decreased in some states in the late 1990s. The National Transportation Safety Board reported that in 1996 PWC represented 7.5% of state-registered recreational boats but accounted for 36% of recreational boating accidents. In the same year PWC operators accounted for more than 41% of the people injured in boating accidents. PWC operators accounted for approximately 85% of the persons injured in accidents studied in 1997 (NTSB 1998). Only one PWC-related injury has been reported at Cape Lookout National Seashore, although much of the waters in the area are outside of park boundaries and many incidents likely are not reported to any agency at all. The park currently does little or no water-based enforcement, which would be necessary to better identify PWC/visitor safety issues. Very few PWC violations have been documented by national seashore staff.

PWC speeds, wakes, and operations near other users can pose hazards and conflicts, especially to canoeists and sea kayakers. Kayakers and canoeists have complained about PWC, and other visitors have complained that PWC use conflicts with swimming and other beach activities.

GUIDING REGULATIONS AND POLICIES

In addition to the guiding regulations and policies discussed in the “Visitor Experience” section, the *NPS Management Policies 2001* [NPS 2001d] state that the NPS is committed to providing appropriate, high-quality opportunities for visitors to enjoy the parks. The policies also state, “While recognizing that there are limitations on its capability to totally eliminate all hazards, the Service and its concessionaires, contractors, and cooperators will seek to provide a safe and healthful environment for visitors and

employees" (sec. 8.2.5.1). Further, the NPS will strive to protect human life and provide for injury-free visits (sec. 8.2.5).

The safe use of PWC is promoted and defined by the state of North Carolina as listed under alternative A in the "Alternatives" chapter. The state's rules describe PWC use, safety requirements, and duties and responsibilities concerning PWC operation.

METHODOLOGY AND ASSUMPTIONS

The methodology for visitor conflicts and safety is similar to that used for visitor experience. The potential visitor-related impacts attributable to PWC — a higher rate of accidents than for other watercraft, conflicts with other park users, negative effects on some types of visitor experiences — could potentially affect the NPS policy to provide for injury-free visits. Potential impacts were identified based on the number and activities of PWC operating within the area, the number and activities of other visitors in an area, and the proximity of these user groups.

It is assumed that North Carolina PWC regulations are enforced within the national seashore boundaries and by other agencies outside NPS jurisdiction. These regulations govern PWC age requirements, the timing of use, operations near other use areas, and reckless operation.

IMPACT ANALYSIS AREA

In terms of visitor safety, the appropriate boundary for analyzing impacts includes national seashore waters that extend 150 from the shoreline during mean low tide, although most PWC operate outside the NPS jurisdiction (NPS 2003c). Additionally, PWC use may affect visitors at beaches near the shoreline, such that visitors within 200 feet of the shore are considered to be within the affected area.

IMPACT OF PWC USE AND CONFLICTING USES ON VISITOR SAFETY

The impact intensities for both visitor conflicts and safety follow. Where impacts on visitor experience or visitor safety become moderate or minor, it is assumed that current visitor satisfaction and safety levels would begin to decline and the park would not be achieving some of its long-term visitor goals.

Negligible: The impact to visitor safety would not be measurable or perceptible.

Minor: The impact would be measurable or perceptible, but it would be limited to a relatively small number of visitors at localized areas. Impacts on visitor safety could be realized through a minor increase or decrease in the potential for visitor conflicts in current accident areas.

Moderate: The impact to visitor safety would be sufficient to cause a permanent change in accident rates at existing low accident locations or to create the potential for additional visitor conflicts in areas that currently do not exhibit noticeable visitor conflict trends.

Major: The impact to visitor safety would be substantial either through the elimination of potential hazards or the creation of new areas with a high potential for serious accidents or hazards.

Impacts of the No-Action Alternative: Continue Prohibition of PWC Use in Cape Lookout National Seashore

Under the no-action alternative, PWC use at the national seashore would continue to be banned. Therefore, no conflicts or safety issues between PWC users and other national seashore visitors would occur, resulting in no impact to visitor conflicts and safety.

Cumulative Impacts. Conflicts and safety issues between various national seashore visitors would continue, such as between other motorboat users and kayakers or swimmers. As visitation increases, particularly as a result of the potential opening the Cape Lookout lighthouse to the public in about 2005, opportunities for conflict and injury would increase, resulting in adverse, long-term impacts of varying intensity, with greater impacts in areas of heavy visitation.

Conclusion. No conflicts or safety issues related to PWC use would occur under this alternative, resulting in no impacts. Cumulative impacts would be adverse, long-term, and of varying intensity depending upon location.

Impacts of Alternative A: Reinstate PWC Use under a Special NPS Regulation as Previously Managed

Analysis. Under alternative A, PWC use would be reinstated throughout the national seashore with no restrictions. This alternative assumes that PWC operations would be reinstated and would increase from an average high use of 36 PWC on a peak day in 2003 to 48 by 2013 in the popular Shackleford Banks area. PWC use is expected to increase from 21 to 28 in the lighthouse area, and from 3 to 4 in the North Core Banks area.

PWC Users / Swimmer Conflicts – No official, guarded swim beaches exist at the national seashore, and visitors swim where they want. Few visitors swim the oceanside of the islands, where PWC use is also rare, although some people surf there. The greatest potential for conflict with swimmers is at the west end of Shackleford Banks, the lighthouse area and Cape Lookout Bight (near the lighthouse), where visitation is heavy and PWC have been known to operate for longer time periods. Many visitors swim in these calmer, soundside waters where access by private boats and ferry is convenient, particularly from the towns of Beaufort, Atlantic Beach, and Morehead City. Visitors have complained that PWC use conflicts with swimming, indicating problems between these users in the past. Impacts on swimmers would be adverse, short- and long-term, and minor in heavily used areas due to the low numbers of PWC that have historically used the national seashore.

PWC Users / Other Boater Conflicts – Other motorized watercraft are distributed throughout the national seashore, but are concentrated at ferry landings and popular visitation sites. PWC and other boaters frequent the same areas, including the soundside of Shackleford Banks and the cove at the Cape Lookout lighthouse. PWC have historically operated for longer periods of time in these heavily used areas, increasing the opportunities for conflicts or accidents. The lighthouse area is primarily accessible via the Barden Inlet, which is extremely congested on busy holiday weekends. This narrow inlet is a likely location for potential conflicts and accidents due to high congestion in a small area. Kayakers and canoeists have complained about PWC use in the past, particularly related to noise and safety issues. These conflicts have occurred at the west end of Shackleford Banks, where kayaking is popular, and other quiet water areas.

PWC Users / Other Visitor Conflicts – PWC users would conflict with other national seashore users, such as soundside anglers and other beach recreationists. Conflicts with PWC users have occurred along the

marshes from Cape Lookout north to New Drum Inlet (despite previously low PWC use in the marsh areas), and in navigation channels, such as Barden Inlet. No accidents or injuries between PWC and non-PWC users have been reported to national seashore staff, although some could have occurred, particularly outside of the park's jurisdiction, and not been reported.

Overall, reinstating PWC use would have adverse, short- and long-term impacts on other visitors at Cape Lookout National Seashore. Because PWC use has historically been very low at the national seashore and conflicts with other users minimal, reinstating PWC use at the national seashore would likely result in adverse, short- and long-term impacts ranging from negligible in the national seashore's north end (where PWC visitation has been very low) to minor near the lighthouse.

Cumulative Impacts. Increasing overall visitation, augmented by substantial increases expected from the opening of the lighthouse to the public, could result in increased conflicts and safety issues between various national seashore visitors with reintroduction of PWC. Impacts would be greatest in the Cape Lookout lighthouse area, where congestion is already high and increased visitation would be concentrated. Impacts would be perceptible to visitors primarily at localized areas, although conflicts or accidents could increase in areas currently not exhibiting conflict trends. Therefore, cumulative impacts would be adverse, long-term and vary from negligible to moderate depending on location.

Conclusion. Impacts on visitor conflicts and safety due to reinstating PWC use throughout the national seashore would be adverse, short- and long-term ranging from negligible in the national seashore's north end to minor near the lighthouse. Cumulative impacts would be adverse, long-term and vary from negligible to moderate depending on location.

Impacts of Alternative B: Reinstate PWC Use under a Special NPS Regulation with Additional Management Prescriptions (Preferred Alternative)

Analysis. Under alternative B, PWC would be reinstated in 10 special use areas throughout the national seashore. All visitors would experience beneficial impacts due to restricting PWC to flat-wake speeds when operating within national seashore boundaries, which should reduce conflicts between PWC and other users, particularly swimmers, anglers, and nonmotorized boaters. In addition, park staff would support the state boater education program; if such support resulted in more PWC operators enrolling in the program, all visitors could experience beneficial impacts as 83% of all PWC operators involved in accidents in North Carolina in 2003 had no formal PWC education.

PWC Users / Swimmer Conflicts – PWC would have access to two special use areas on the soundside of Shackleford Banks, with a non-use area in between where the maritime forest fronts the shoreline. This non-use area was chosen based on congestion and safety issues at the island, where swimming and beach activities (including overnight camping) are common. Therefore, by restricting PWC use in this popular area, impacts on swimmers would be reduced compared to reinstating PWC throughout the entire island, and impacts would be negligible to minor and of short duration in this area.

PWC Users / Other Boater Conflicts – As described under alternative A, other motorized watercraft frequent the same areas, including the soundside of Shackleford Banks and the cove at the Cape Lookout lighthouse. Under this alternative, PWC would have access to the same areas that are popular with boaters. The lighthouse area has been popular with PWC users in the past and continues to be a strong attraction for all national seashore visitors. PWC would be permitted to operate in three use areas in the cove, being most restricted in the boat docking areas near the lighthouse and the marshes near Catfish Point. A landing zone 300 feet north of the NPS ferry dock should help distribute PWC users accessing

this area. Such restrictions, along with flat-wake speed requirements, should help alleviate potential conflicts with other boaters in this popular area and keep adverse impacts on minor levels.

PWC would not be permitted to use marshlands along the North and South Core Banks, where kayakers have complained about PWC use in marshes from Cape Lookout north to New Drum Inlet. Conflicts and potential for accidents would be minimal farther north, where PWC use has historically been extremely low.

PWC Users / Other Visitor Conflicts – As described under alternative A, PWC users would continue to conflict with other national seashore users, such as soundside anglers and other beach recreationists. However, anglers fishing near the maritime forest on Shackleford Banks would benefit from PWC prohibition in this area. No accidents or injuries between PWC and non-PWC users have been reported to national seashore staff, although some could have occurred, particularly outside of the park's jurisdiction, and not been reported.

Overall, reinstating PWC use in restricted areas would result in adverse, short- and long-term impacts that would vary from negligible in low-use areas, to minor in localized, high-use areas where a small number of visitors would be affected due the low numbers of PWC accessing the national seashore in restricted use areas, as well as the flat-wake speed restrictions called for under this alternative.

Cumulative Impacts. Cumulative impacts would be similar to those described under alternative A, although PWC use would be restricted to specific areas of the national seashore. When combined with increased visitation expected throughout the national seashore, particularly at the Cape Lookout lighthouse area, reinstating PWC would increase potential for conflicts and accidents, particularly in localized areas. However, the restrictions on Shackleford and the Cape Lookout area would help alleviate such problems. Therefore, cumulative impacts would be adverse, long-term and vary from negligible to moderate depending on location.

Conclusion. Reinstating PWC use in restricted areas would result in adverse, short- and long-term impacts that would vary from negligible in low-use areas, to minor in localized, high-use areas where a small number of visitors would be affected due the low numbers of PWC accessing the national seashore in restricted use areas. Cumulative impacts would be adverse, long-term and vary from negligible to moderate depending on location.

CULTURAL RESOURCES

GUIDING REGULATIONS AND POLICIES

The NPS's primary interest in cultural resources — archeological resources and districts, historic structures and districts, cultural landscapes, ethnographic resources, and museum collections — stems from its responsibilities under the following legislation:

> The *NPS Organic Act of 1916* – responsibility to conserve the natural and historic objects within parks unimpaired for the enjoyment of future generations
>
> *National Historic Preservation Act* – responsibility to preserve, conserve, and encourage the continuation of the diverse traditional prehistoric, historic, ethnic, and folk cultural traditions that underlie and are a living expression of our American heritage

American Indian Religious Freedom Act – responsibility to protect and preserve for Native American Indians access to sites, use and possession of sacred objects, and the freedom to worship through ceremonials and traditional rites

Archaeological Resources Protection Act – responsibility to secure, for the present and future benefit of the American people, the protection of archaeological resources and sites that are on public lands

Executive Order 13007 – responsibility to (1) accommodate access to and ceremonial use of Native American Indian sacred sites by Native American Indian religious practitioners, and (2) avoid adversely affecting the physical integrity of such sacred sites.

In accordance with the *NPS Management Policies 2001* (NPS 2001d), the NPS must be respectful of these ethnographic resources, and carefully consider the effects that NPS actions may have on them (*NPS Management Policies 2001*, sec. 5.3.5.3 [NPS 2001d]).

METHODOLOGY AND ASSUMPTIONS

In this environmental assessment impacts on cultural resources are described in terms of type, context, duration, and intensity, which is consistent with the CEQ regulations. Historic structures, cultural landscapes, ethnographic resources, and museum collections have been dismissed from further analysis for reasons given in the "Purpose of and Need for Action." The following impact analyses are intended to also comply with the requirements of section 106 of the *National Historic Preservation Act* (36 CFR Part 800, "Protection of Historic Properties"). In accordance with the Advisory Council on Historic Preservation's regulations implementing section 106, impacts on cultural resources were identified and evaluated by:

1. Determining the area of potential effects;

2. Identifying cultural resources present in the area of potential effects that were either listed on or eligible to be listed on the National Register of Historic Places;

3. Applying the criteria of adverse effect to affected cultural resources either listed on or eligible to be listed on the National Register; and

4. Considering ways to avoid, minimize or mitigate adverse effects.

Under the advisory council's regulations, a determination of either adverse effect or no adverse effect must be made for affected, national register eligible cultural resources.

An adverse effect occurs whenever an impact alters, directly or indirectly, any characteristic of a cultural resource that qualifies it for inclusion on the national register. Examples include diminishing the integrity of the resource's location, design, setting, materials, workmanship, feeling, or association. Adverse effects also include reasonably foreseeable effects that would occur later in time, be farther removed in distance, or be cumulative (36 CFR 800.5).

A determination of no adverse effect means there may be an effect, but the effect would not diminish in any way the characteristics of the cultural resource that qualify it for inclusion in the National Register.

The CEQ regulations and *Director's Order #12* (NPS 2001c) and its handbook call for a discussion of the appropriateness of mitigation, as well as an analysis of how effective the mitigation would be in reducing the intensity of a potential impact (e.g., reducing the intensity of an impact from major to moderate or minor). Any resultant reduction in intensity of impact due to mitigation, however, is an estimate of the effectiveness of mitigation under the NEPA only. It does not suggest that the level of effect as defined by section 106 is similarly reduced. Although adverse effects under section 106 may be mitigated, the effect remains adverse.

A section 106 summary is included in the impact analysis section and is intended to meet the requirements of the *National Historic Preservation Act*. It also is intended to provide an assessment of the effect of implementing the alternatives on cultural resources, based on the criteria found in the advisory council's regulations.

IMPACT ANALYSIS AREA

For the purposes of this evaluation, the impact analysis area includes the shoreline and a 200-foot inland area where PWC operators may land and explore the shoreline but remain in sight of their PWC.

MAGNITUDE OF EFFECTS

Certain important research questions about human history can only be answered by the actual physical material of cultural resources. Archaeological resources have the potential to answer, in whole or in part, such research questions. An archaeological site(s) can be eligible to be listed on the National Register of Historic Places if the site(s) has yielded, or may be likely to yield, information important in prehistory or history. An archaeological site(s) can be nominated to the National Register in one of three historic contexts or levels of significance: local, state, or national (National Register Bulletin #15, *How to Apply the National Register Criteria for Evaluation*). For purposes of analyzing impacts on archaeological resources, thresholds of change for the intensity of an impact are based upon the potential of the site(s) to yield information important in prehistory or history, as well as the probable historic context of the affected site(s):

Negligible: Impact is at the lowest levels of detection – barely measurable with no perceptible consequences, either adverse or beneficial. For purposes of section 106, the determination of effect would be *no adverse effect*.

Minor: **Beneficial impact** – maintenance and preservation of a site(s). For purposes of section 106, the determination of effect would be *no adverse effect*.
Adverse impact – disturbance of a site(s) results in little, if any, loss of integrity. For purposes of section 106, the determination of effect would be *no adverse effect*.

Moderate: **Beneficial impact** – stabilization of a site(s). For purposes of section 106, the determination of effect would be *no adverse effect*.
Adverse impact – disturbance of a site(s) results in loss of integrity. For purposes of section 106, the determination of effect would be *adverse effect*. A memorandum of agreement is executed among the NPS and applicable state or Tribal Historic Preservation Officer and, if necessary, the Advisory Council on Historic Preservation in accordance with 36 CFR 800.6(b). The mitigative

measures identified in the memorandum of agreement reduce the intensity of impact under NEPA from major to moderate.

Major: **Beneficial impact** – active intervention to preserve a site(s). For purposes of section 106, the determination of effect would be *no adverse effect*.
Adverse impact – disturbance of a site(s) results in loss of integrity. For purposes of section 106, the determination of effect would be *adverse effect*. The NPS and applicable State or Tribal Historic Preservation Officer are unable to negotiate and execute a memorandum of agreement in accordance with 36 CFR 800.6(b).

Impairment: A major, adverse impact to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Cape Lookout National Seashore; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's master plan or other relevant NPS planning documents. Project inventories and mitigation would still be conducted. However, without a systematic monitoring program and given the potential access concerns, there would continue to be a risk of some unavoidable adverse impacts.

Impacts of the No-Action Alternative: Continue Prohibition of PWC Use in Cape Lookout National Seashore

Analysis. Under this alternative PWC use would not be reinstated within the national seashore. Implementation of the no-action alternative would result in no impacts from PWC on archaeological sites or submerged features by continuing to limit the potential for illegal collection or inadvertent damage that could be caused by PWC users.

Cumulative Impacts. Even without the potential for PWC users to access archeological sites, the effects of other watercraft users and other visitors would still have the potential for cumulative impacts. On a cumulative basis, potential visitor impacts from illegally collecting or damaging resources would continue to be a possibility, particularly as visitation increases in the long-term. However, most of the national seashore's archeological sites are almost entirely obliterated or submerged, making identification of these sites difficult. Other sites are covered with thick vegetation, also making them difficult to notice and vandalize. Furthermore, park staff have noted that very little vandalism or looting of cultural resources occurs at the national seashore. Therefore, impacts from vandalism or illegal collecting would be negligible. Wave action from other boaters would adversely impact these sites. In addition, the wild horses on Shackleford have and could continue to trammel archeological sites, although some are submerged or located in marshes on satellite islands and out of the horses' reach. Past use of the area by sheep and goats could have also adversely impacted these sites. However, impacts from natural events, such as erosion, storms, hurricanes, and barrier island movement, would continue to be the primary contributing factor to degradation of the national seashore's archeological sites. Overall cumulative impacts from human caused or managed events would be adverse, long-term, and negligible.

Conclusion. Continuing the ban on PWC use within national seashore waters would have no impacts on archaeological and submerged sites. Adverse cumulative impacts from illegal collecting, wave action from other boats, and wild horses would be long-term and negligible.

Implementation of this alternative would not result in an impairment of cultural resources.

Impacts of Alternative A: Reinstate PWC Use under a Special NPS Regulation as Previously Managed

Analysis. PWC users would have access to the entire national seashore, including archaeological resources under this alternative. However, most of the sites have been nearly obliterated by natural events, are submerged under water, or are obscured by vegetation, making detection difficult. Park staff have noted that vandalism and collection of archeological resources is infrequent. In addition, approximately only 1% of all national seashore visitors have historically been PWC users, and most archeological sites exist in marshy areas, which PWC typically avoid. Therefore, reinstating PWC use throughout the national seashore would result in negligible adverse impacts on archeological sites from vandalism or illegal collection.

Because PWC would be allowed to operate parallel to the shoreline, impacts on archeological sites could occur from wave action. However, since PWC would likely constitute only 1% of all park visitors, impacts would be extremely small, particularly compared to the severe effects of hurricanes, storms, erosion, and barrier island movement. In addition, PWC would likely avoid the marshy areas where many of the archeological sites exist.

Reinstating PWC use is not expected to substantially affect the overall condition of archeological resources, resulting in adverse, long-term, negligible impacts.

Cumulative Impacts. As described under alternative A, other boaters and visitors would have access to archaeological sites; impacts from these users would be combined with impacts from PWC users. However, impacts from vandalism and illegal collecting would be negligible due to the difficulty in identifying these rapidly eroding sites, as described above. Adverse effects due to wave action from boats would continue to impact aboriginal sites and would be augmented by waves from PWC use. However, the small percentage of PWC users expected under this alternative would result in negligible impacts from increased wave action. Impacts from wild horses would also continue as under alternative A. Past use of the area by sheep and goats could have also adversely impacted these sites. Erosion due to natural causes such as storm events would continue to result in the most damaging impacts on archeological sites. Therefore, cumulative impacts resulting from human caused or managed events would adverse, long-term, and negligible.

Conclusion. Reinstating PWC use is not expected to substantially affect the overall condition of archeological resources, resulting in adverse, long-term, negligible impacts. Cumulative impacts resulting from vandalism, illegal collecting, wave action from boats, and wild horses would be adverse, long-term, and negligible.

Implementation of this alternative would not result in an impairment of cultural resources.

Impacts of Alternative B: Reinstate PWC Use under a Special NPS Regulation with Additional Management Prescriptions (Preferred Alternative)

Analysis. Under alternative B, PWC users would have access to specific locations within the national seashore. When riding within NPS jurisdiction, PWC would be required to operate perpendicular to the shore and at flat-wake speed. Therefore, impacts on archeological sites from wave action would be greatly minimized. In addition, very few PWC have historically used the national seashore, and most would not operate in salt marsh areas where many archeological sites are located, further reducing the potential for adverse impact. Therefore, no to negligible long-term, adverse impacts from PWC wave action would be expected.

Potential impacts resulting from vandalism and illegal collection would be similar to those expected under alternative A. However, the PWC landing restrictions on Shackleford and Cape Lookout would prevent PWC from landing in areas with archeological sites. Although PWC users could land in the designated areas and walk to some sites, many are submerged or located in salt marshes on small satellite islands, which are difficult to access by foot or PWC. Other sites are obscured by thick vegetation and difficult to identify. Therefore, impacts from vandalism and looting (which have historically been insubstantial) are expected to be adverse, long-term, but negligible.

Cumulative Impacts. As described under alternative B, impacts from other boaters and visitors would be combined with impacts from PWC users. However, impacts from vandalism and illegal collecting would be negligible due to the difficulty in identifying these sites, as described above. Adverse effects due to wave action from boats would continue to impact aboriginal sites, but would not be appreciably augmented by waves from PWC use due to the flat-wake speed and perpendicular approach restrictions described under this alternative. Wild horses would continue to impact archeological sites as described under alternative A. Past use of the area by sheep and goats could have also adversely impacted these sites. Erosion due to natural causes would continue to result in the most damaging impacts on archeological sites. Therefore, cumulative impacts resulting from vandalism, illegal collecting, waves from boats, and wild horses would be adverse, long-term, and negligible.

Conclusion. Restricting areas of use and requiring PWC to operate perpendicular to the shore and at flat-wake speed within the national seashore's jurisdiction would minimize impacts on archaeological resources from wave action. Restricting areas of use would also minimize impacts resulting from vandalism and illegal collecting. Cumulative impacts would be adverse, long-term, and negligible.

Implementation of this alternative would not result in an impairment of cultural resources.

SECTION 106 SUMMARY

This draft environmental assessment provides detailed descriptions of three alternatives (including a no-action alternative) and analyzes the potential impacts associated with possible implementation of each alternative. The analysis of potential impacts of PWC at Cape Lookout National Seashore also considered access by other types of watercraft.

Visitors access the national seashore by a variety of watercraft (primarily motorboats) since no means of land-based vehicular access is provided. Storm events, hurricanes, natural erosional processes, past use by sheep and goats, and barrier island movement have historically impacted archeological sites far more than human-caused events. Therefore, the impacts on archeological resources directly attributable to PWC users are difficult to define but are expected to be negligible under all alternatives.

Under the no-action alternative, PWC would continue to be banned within the national seashore, resulting in "no adverse effect" to archeological resources.

Under alternative A, PWC would have unlimited access to the national seashore as they did prior to the ban. However, the historically small number of PWC users at the park (approximately 1%) would result in negligible impacts on archeological resources from wave action or vandalism and illegal collecting. In addition, the national seashore's archeological sites are often submerged, partially obliterated, or obscured under thick vegetation, making them difficult to identify. Furthermore, several sites exist in salt marshes, which PWC avoid. Therefore, impacts on archeological resources expected under alternative A would also constitute "no adverse effect."

Flat-wake speed and perpendicular access restrictions within the national seashore's jurisdiction as described under alternative B would provide protection to archeological sites from wave action. Restricted landing access called for under this alternative would also limit the amount of vandalism and illegal collecting. "No adverse effect" is expected to archeological resources under alternative B as well.

The state of North Carolina states that no person shall operate a PWC at greater than no-wake speed within 100 feet of an anchored or moored vessel, a dock, pier, swim float, marked swimming area, swimmers, surfers, persons engaged in angling, or any manually operated propelled vessel, unless the PWC is operating in a narrow channel, defined as a segment of water 300 feet or less in width (PWC operation is reduced to 50 feet within these areas in a narrow channel). The presence of docks, swimmers, anglers, or other vessels in the vicinity of archeological sites would therefore require PWC to operate at no-wake speed under alternatives A and B, further protecting these sites from PWC-induced wave action.

In cases where it was determined there was a potential for adverse impacts on cultural resources listed on or eligible for listing on the National Register of Historic Places, the NPS would coordinate with the North Carolina state historic preservation officer to determine the level of effect on the property and the needed mitigation measures.

Pursuant to 36 CFR 800.5 (revised effective January 2001), the NPS finds that the implementation of any alternative being considered for PWC use at Cape Lookout National Seashore, with identified mitigation measures, would not result in any new adverse effects (no adverse effect) to archeological resources within the national seashore.

SOCIOECONOMIC EFFECTS

This section summarizes the socioeconomic impacts associated with the proposed alternatives for PWC use in Cape Lookout National Seashore. A detailed description of these impacts and a complete list of references is provided in the report "Economic Analysis of Personal Watercraft Regulations in Cape Lookout National Seashore" (LAW 2004).

Reinstating PWC use in Cape Lookout may affect the local economy in several ways, including changes in park visitation, sales and profits of local businesses, local employment, and local and state sales tax revenue. Generally, allowing PWC use in the national seashore would be expected to slightly increase economic activity in the areas surrounding the national seashore. However, the incremental impacts under alternatives A and B are expected to be small relative to the size of the local economy. Because PWC users account for a very small fraction of economic activity in the region, it is very unlikely that there will be any measurable incremental impacts on the regions' economy.

BENEFIT-COST ANALYSIS

The purpose of benefit-cost analysis is to determine whether a proposed alternative—in this case the management of PWC use at Cape Lookout National Seashore—would generate more benefits than costs. These costs and benefits accrue directly to households that use PWC, and indirectly to those who are affected by PWC use (e.g., those who would benefit from reduced noise). The resulting changes in PWC use could also impose costs on those who own or work for PWC-related businesses.

The extent to which adverse impacts will be realized is a function of several factors, including the level of use, the technology of the machines being used, and the extent to which users remain in designated areas. Adverse impacts impose welfare losses on individuals who value the parks' environmental systems. The

costs of allowing PWC in national parks can therefore be thought of and measured as the increase in these incremental losses to society. In addition, use of PWC can negatively affect society in ways that are not directly related to the environment; therefore, the incremental costs of PWC regulations must also include increases in these non-environmental losses.

Impacts can, directly or indirectly, lead to losses in human welfare. Therefore, from a benefit-cost perspective, those who ultimately lose from actions to allow PWC will be individuals who value the quality of the park environment. Many of those that experience losses will be park visitors whose recreational experiences are disturbed. Even individuals who are not park visitors (i.e., nonusers) can benefit from the knowledge that park resources are being protected and preserved. In other words, they may hold positive or negative "nonuse values" for protecting or degrading the park environment.

For the purpose of this study, six major affected groups have been identified:

1. PWC users, in particular those who used PWC in Cape Lookout prior to the April 2002 ban and those who may wish to use PWC at the national seashore in the future.

2. Other visitors or potential visitors who may have a different experience at the park if PWC use is reinstated (canoeists, anglers, swimmers, hikers, boaters, and other visitors).

3. Producers of PWC services (e.g., PWC rental shops, PWC sales shops, restaurants, gas stations, hotels) in the area surrounding Cape Lookout who may experience a change in their welfare if PWC use in the park changes.

4. Local residents of the area surrounding Cape Lookout.

5. Producers of services to other types of summer visitors (e.g., canoe rentals or powerboat rentals) who may experience a change in their welfare related to the number of PWC users in the park.

6. The general public who may care about the natural resources in Cape Lookout even if they do not visit the park.

The no-action alternative, which maintains the ban on PWC, would have no effect on any user group relative to baseline conditions.

Alternative A, which reinstates PWC use as managed prior to the ban, would have a negative effect on most user groups except for PWC users and the businesses that cater to them. PWC users, PWC dealerships, and other businesses that provide services to PWC users are expected to experience gains of consumer and producer surplus. Adverse impacts of PWC on anglers, swimmers, canoeists, and other users within Cape Lookout National Seashore relative to the baseline would increase somewhat under this alternative because PWC would be allowed within the park's boundaries. The impact on boaters is ambiguous. Allowing PWC in the park should have negative impacts on other boaters' consumer surplus because of the increased probability of accidents between boaters and PWC users and increased noise levels. However, there is some overlap between people that use PWC and those that use other types of boats. Users of houseboats, powerboats, and other non-PWC boats may enjoy using PWC as part of their boating trips and may experience welfare gains as a result of lifting the ban.

Alternative B is expected to have a similar effect on all park user groups as alternative A, except some PWC users who may consider the geographic restrictions to be a negative impact. PWC use would be limited to special use areas, with additional restrictions of only operating perpendicular to the shore at

flat-wake speeds. The restrictions proposed under alternative B would result in lower PWC sales and other PWC-related business revenues increases relative to alternative A.

COSTS/BENEFITS TO PWC USERS

PWC users, as well as some businesses in the local area, may experience welfare gains as a result of the proposed alternative regulations.

Two main groups of PWC users may be affected by the regulations: those who used PWC at the national seashore and those who use PWC in substitute areas outside of Cape Lookout where PWC users displaced from the national seashore ride because of the NPS ban. PWC users who currently ride in areas where displaced riders from Cape Lookout may have visited will gain some consumer surplus if these areas are less crowded than under baseline conditions because of reinstating PWC use in Cape Lookout. For PWC users who rode in the national seashore or who want to ride in the park in the future, allowing PWC use in the park could result in consumer surplus gains. To the extent that individuals consider other PWC areas close substitutes, the change in consumer surplus associated with allowing PWC use in the park would be lower.

No-Action Alternative: The no-action alternative would maintain the current ban on PWC use in Cape Lookout. This would not change regulations relative to baseline conditions and would not have any incremental impact on the consumer surplus of any user group.

Alternative A: This alternative would reinstate PWC use in Cape Lookout as previously managed. All visitors using PWC in the national seashore prior to the ban are assumed to regain the full value of their consumer surplus for PWC use in Cape Lookout.

Alternative B: This alternative, much like alternative A, would allow PWC use in Cape Lookout but would maintain a ban on PWC use in all but the special use areas and require PWC to operate at flat-wake speed perpendicular to the shore. These restrictions may cause PWC users who frequent these areas to regain only a portion of their consumer surplus. However, little difference between consumer surplus gains are expected under this alternative and alternative A.

COSTS TO NON-PWC USERS

Those bearing the largest share of the costs as a result of implementing alternative A or B would be visitors who do not use PWC and whose park experience would be negatively affected by the presence of PWC in the park. The no-action alternative is not expected to result in any incremental costs to park users because it continues baseline use patterns. “Nonusers” of the park are also likely to bear the costs as a result of PWC regulations in Cape Lookout. For example, individuals who do not visit the parks can experience a decline in welfare simply from the knowledge that the natural resources of the park may be degraded by PWC use. Part of this loss may stem from a decreased assurance that the quality of the park’s resources is being protected for the enjoyment of future generations.

COSTS/BENEFITS TO LOCAL AREA BUSINESS

If PWC use increases as a result of the regulation, then the suppliers of PWC rentals, sales, and service would be directly affected. In addition, lodging establishments, restaurants, gas stations, and other businesses that serve PWC riders could experience an increase in business from the regulation.

PWC Sales, Rental, and Associated Businesses Serving Cape Lookout National Seashore. One PWC rental firm and four sales/service shops exist in the Cape Lookout area. It was assumed that all five firms would be affected by changes to PWC regulations in national seashore even though many of the firms mentioned alternative locations for PWC use in the area. PWC dealerships contacted believed that restrictions on PWC use at Cape Lookout have caused a reduction in sales. The rental shop contacted believed that the implementation of alternative A or B might result in an increase in its PWC rentals. Increased revenue to these businesses is expected under implementation of alternative A or B, more so under alternative A.

Lodging Establishments, Restaurants, Gas Stations, and Other Businesses. Purchases made by PWC users contribute to total economic activity in the area surrounding Cape Lookout. It is possible that localized impacts on tourism-related businesses located near Cape Lookout would occur if PWC regulations result in increased visitation to the recreation area. Lodging establishments, restaurants, gas stations, and other businesses that serve PWC riders are not likely to experience a large increase in business under any of the alternatives.

The no-action alternative is not expected to result in revenue gains to firms relative to the baseline. However, visitation by non-PWC users may have increased in response to the PWC ban. Based on the existing data and interviews with local businesses, calculated revenue gains would occur under alternatives A and B for the following business categories: PWC rentals, PWC sales, lodging, restaurants, supermarkets, gasoline, local transportation, admissions/fees, clothing shops, sporting goods shops, and souvenir/retail shops.

Conclusion. There are no incremental benefits or costs associated with the no-action alternative. The primary beneficiaries of alternative A or B would be PWC users and the businesses that provide services to them. Additional beneficiaries include individuals who use PWC outside the park where displaced PWC users may decide to ride if the NPS ban continued. The primary group that would incur costs under alternative A or B is park visitors who do not use PWC and whose experiences would be negatively affected by PWC use within the park. Additionally, the public could incur costs associated with impacts from alternative A or B to other park values, such as noise and safety. However, because PWC users account for a very small fraction of economic activity in the region, it is very unlikely that there will be any measurable incremental impacts on the region's economy.

CAPE LOOKOUT NATIONAL SEASHORE MANAGEMENT AND OPERATIONS

CONFLICT WITH STATE AND LOCAL PWC ORDINANCES AND POLICIES

Some states and local governments have taken action, or are considering taking action, to limit, ban, or otherwise manage PWC use. While a national park system unit may be exempt from these local actions, consistency with state and local plans must be evaluated in accordance with NEPA.

The state of North Carolina has PWC-specific regulations that are listed in the "Alternatives" chapter. Many local North Carolina jurisdictions have adopted supplemental or more stringent PWC regulations.

Impacts related to conflicts with state and local ordinances have been analyzed qualitatively using professional judgment to define thresholds or impact magnitude.

Impacts of the No-Action Alternative: Continue Prohibition of PWC Use in Cape Lookout National Seashore

Analysis. The no-action alternative would continue the ban on PWC use within the boundaries of the national seashore. The NPS has the right to regulate the types of activities that take place under its jurisdiction, but North Carolina Marine Patrol and the U.S. Coast Guard would not enforce park-specific restrictions. State PWC regulations do not have provisions that forbid additional controls or bans; thus, additional restrictions would not be in conflict with state regulations or policies. The no-action alternative would not be in conflict with national, federal, or state regulations or policies.

Cumulative Impacts. All the areas where PWC use occurs in the waters outside Cape Lookout National Seashore's boundaries are subject to the same state PWC regulations. Some areas may also have their own policies or requirements, or follow local requirements. PWC use is prohibited at nearby Cape Hatteras National Seashore, which lies immediately north of Cape Lookout. PWC use is also prohibited at Fort Macon State Park, which is just west of Shackleford Banks across Beaufort Inlet. Hammocks Beach State Park, which is approximately 30 miles west of Beaufort Inlet, does permit PWC use. A PWC ban within Cape Lookout National Seashore would not create conflicts with other areas that support PWC use or increase any known conflicts with such requirements. There would be no cumulative impacts relating to regulation conflicts.

Conclusion. Discontinuing PWC use within the national seashore would not result in conflict with state PWC regulations. There are no national or local PWC regulations. Therefore, there would be no impacts (including cumulative impacts) related to such conflicts.

Impacts of Alternative A: Reinstate PWC Use under a Special NPS Regulation as Previously Managed

Analysis. PWC users at the national seashore would be required to follow all applicable state regulations, as well as NPS regulations. Under this alternative NPS rangers would enforce all state regulations within the national seashore, and there would be no conflicts between park regulations and other regulations. No impacts would be associated with alternative A since no conflicts with state regulations would occur.

Cumulative Impacts. Cumulative impacts would be similar to those described under the no-action alternative. All the areas where PWC use occurs in the waters outside Cape Lookout National Seashore's boundaries are subject to the same state PWC regulations. There would be no cumulative impacts relating to regulation conflicts.

Conclusion. PWC and boating regulations within the national seashore would be the same as state regulations. Continued PWC use under alternative A would not result in conflicts with state regulations. Therefore, there would be no impacts (including cumulative impacts) related to such conflicts.

Impacts of Alternative B: Reinstate PWC Use under a Special NPS Regulation with Additional Management Prescriptions (Preferred Alternative)

Analysis. As under alternative B, PWC users at the national seashore would be required to follow all applicable state regulations, as well as special NPS regulations defined under this alternative. NPS rangers would enforce all state regulations within the national seashore, and there would be no conflicts between the special park regulations and other regulations, including state regulations.

Cumulative Impacts. Cumulative impacts would be similar to those described under the no-action alternative. All the areas where PWC use occurs in the waters outside Cape Lookout National Seashore's boundaries are subject to the same state PWC regulations. There would be no cumulative impacts relating to regulation conflicts.

Conclusion. PWC and boating regulations within the national seashore would incorporate state regulations as well as special regulations specifically defined under this alternative. Continued PWC use under alternative B would not result in conflicts between state regulations and the additional restrictions defined under this alternative. Therefore, there would be no impacts (including cumulative impacts) related to such conflicts.

IMPACT TO PARK OPERATIONS FROM INCREASED ENFORCEMENT NEEDS

Director's Order #9: Law Enforcement Program (NPS 2000a), in conjunction with *Reference Manual 9: Law Enforcement*, establishes and defines standards and procedures for NPS law enforcement. Along with education and resource management, law enforcement is an important tool in achieving the NPS goals to protect human life and provide for injury-free visits. Commissioned rangers perform resource stewardship, education, and visitor use management activities, including law enforcement. They provide for tranquil, sustainable use and enjoyment of park resources, while simultaneously protecting these resources from all forms of degradation. The objectives of the law enforcement program are to (1) prevent criminal activities through resource education, public safety efforts, and deterrence, (2) detect and investigate criminal activity, and (3) apprehend and successfully prosecute criminal violators.

The U.S. Coast Guard, the North Carolina Marine Patrol, and the North Carolina Wildlife Resources Commission would continue to conduct law enforcement and rescue operations in national seashore waters; they would not enforce park-specific PWC regulations. Impacts on park operations from increased enforcement needs have been analyzed qualitatively using professional judgment to define thresholds or impact magnitude.

Impacts of the No-Action Alternative: Continue Prohibition of PWC Use in Cape Lookout National Seashore

Analysis. Continuing the PWC ban throughout Cape Lookout National Seashore would eliminate potential conflicts between PWC recreationists and other user groups. Therefore, no additional park staff would be required to enforce PWC safety regulations or respond to PWC-related accidents or complaints. Because PWC have been banned at the national seashore since April 22, 2002, the public has had time to adjust to the ban; no additional park staff would be required to enforce PWC prohibitions or educate the public. Continuation of the PWC ban would give park staff more time to focus on other high priority activities.

Cumulative Impacts. Increasing overall visitation, augmented by substantial increases expected from the opening of the lighthouse to the public, could place an increased demand on national seashore staff, which is already understaffed. Impacts would be greatest in the Cape Lookout lighthouse area, where congestion is already high and increased visitation would be concentrated. Cumulative impacts would be adverse, long-term and minor to moderate given the current and expected staffing deficiencies.

Conclusion. The no-action alternative would initially result in no impacts on park management and operations because the ban has been in effect since 2002. Park staff would not need to divert resources to focus on PWC-related activities, even though PWC use and related conflicts have been historically low.

Cumulative impacts related to increased visitation would continue, but there would be no contribution from PWC use. Cumulative impacts would be adverse, long-term and minor to moderate given the current and expected staffing deficiencies.

Impacts of Alternative A: Reinstate PWC Use under a Special NPS Regulation as Previously Managed

Analysis. Under alternative A, park staff, the U.S. Coast Guard, the North Carolina Marine Patrol, and North Carolina Wildlife Resources Commission would continue to patrol the national seashore. However, national seashore staff currently does little or no water-based enforcement, and the U.S. Coast Guard and state marine patrol do not enforce state PWC regulations within the national seashore. Current national seashore staffing levels are not sufficient to enforce PWC regulations, and PWC enforcement would divert resources from other high priority activities. Therefore, an increase in law enforcement staffing would be needed to patrol and enforce the regulations. Despite historically low PWC use, impacts would be adverse, long-term, and minor to moderate due to inadequate staffing levels.

Cumulative Impacts. Impacts from reinstating PWC throughout the national seashore would be combined with projected increases in visitation, particularly at the lighthouse. National seashore staff is currently not sufficient to handle the anticipated increased in visitation; therefore, the cumulative effects of reinstating PWC use would result in long-term, adverse, minor to moderate impacts on park management and operations.

Conclusion. Alternative A would have long-term, adverse, minor to moderate impacts on park management and operations due to increased enforcement needs related to reinstating PWC throughout the national seashore and insufficient staffing.

Cumulative impacts would also be long-term, adverse, minor to moderate.

Impacts of Alternative B: Reinstate PWC Use under a Special NPS Regulation with Additional Management Prescriptions (Preferred Alternative)

Analysis. Reinstating PWC use with restricted access would require increased education and enforcement actions by park staff. PWC users may not be aware that their access is restricted and that operations within national seashore boundaries would be limited to flat-wake speed, despite attempts by park staff to educate visitors about PWC regulations and help them understand the differences between park regulations and non-park regulations. Without sufficient education and enforcement, PWC users may believe that the entire national seashore would be open to PWC users as it had in the past. Therefore, park staff would likely need to increase boat patrols, monitor areas by land, and increase the number of rangers in the short-term to educate national seashore visitors. Educational materials would need to be posted at the national seashore's visitor center, the lighthouse, the park web site, and distributed to PWC users at docks or marinas.

Extra staff time would be needed initially to educate visitors about the closed areas. As the public became more aware of the new restrictions, enforcement and education time would be reduced, although current routine boat patrols would likely not be sufficient to enforce the new regulations. Adverse impacts on park operations would be moderate in the short-term and minor over the long-term as the public began to understand and comply with the new rules, which would restrict PWC use and require flat-wake speed within park waters, possibly reducing the need for as much enforcement as compared to alternative A.

Cumulative Impacts. Cumulative impacts resulting from increased visitation would be similar to those expected under alternative A, although additional short-term impacts related to education expected under

this alternative would be added to the overall cumulative effects. Therefore, cumulative impacts would be adverse, short- and long-term, and minor to moderate.

Conclusion. Alternative B would have short-term, moderate adverse impacts on park operations due to the additional duties that would be required by NPS staff to implement and enforce the new PWC regulations and to educate visitors. Long-term impacts would be reduced to minor as the public began to understand the new rules.

Cumulative impacts would be minor to moderate due to expected increases in visitation.

UNAVOIDABLE ADVERSE IMPACTS

Unavoidable adverse impacts are impacts that cannot be avoided and cannot be mitigated, and therefore would remain throughout the duration of the action. The following list describes potential adverse impacts related to the alternatives being considered:

- PWC use would continue to cause minor levels of pollutant emissions into national seashore water and air under alternatives A and B. These impacts would decrease in the long-term due to the required improvements in engine emission technology.

- PWC use and landing along the shoreline under alternatives A and B would have adverse impacts on the park's natural soundscape and could occasionally cause flight response in wildlife that are present along the shore.

- Submerged aquatic vegetation could be adversely affected by PWC users under alternatives A and B. These impacts would not be substantial and would not cause long-term changes in vegetation.

- Continued PWC use under alternatives A and B would have adverse impacts on the experiences of other visitors, through occasional noise and visual intrusions. Under the no-action alternative, PWC users who could no longer ride within the national seashore would be adversely affected.

LOSS IN LONG-TERM AVAILABILITY OR PRODUCTIVITY TO ACHIEVE SHORT-TERM GAIN

None of these resources would be impacted to the point of impairment or long-term permanent loss.

IRREVERSIBLE OR IRRETRIEVABLE COMMITMENTS OF RESOURCES

Irreversible impacts are those effects that cannot be changed over the long-term or are permanent. An effect to a resource is irreversible if the resource cannot be reclaimed, restored, or otherwise returned to its condition prior to the disturbance.

Irretrievable commitments of resources are those that, once gone, cannot be replaced; that is, the commitment of a renewable resource or the short-term commitment of any resource. These include the commitment of water quality and air quality by allowing all mobile sources desiring to do so, including PWC, to continue using the national seashore under alternatives A and B. The use of fossil fuels to power PWC would be an irretrievable commitment of this resource; however, this use is minor.

CONSULTATION AND COORDINATION

Various management and safety issues regarding PWC use were discussed throughout the development of the *PWC Determination* for the national seashore from 2001 through completion in 2004. National seashore visitors, local governments, conservation interests, the state's Congressional delegation, and the general public were consulted extensively throughout development of the *PWC Determination* in public meetings and newsletters, the draft and final *PWC Determination,* and development of this EA.

Public comment from 1998 until about April 25, 2001 resulted in approximately 205 unsolicited emails or letters in support of the ban and 2 letters in opposition to the ban. Beginning the spring of 2001, the following meetings were conducted and press releases published on the PWC closure, the EA process, and related issues.

PWC DETERMINATION AND CLOSURE

- March 28, 2001, press release: "Cape Lookout National Seashore Prohibits Personal Watercraft Use."

- March 29, 2001, web site posting: "Determination on Appropriateness of Personal Watercraft (PWC) Use at Cape Lookout National Seashore" posted on park web site.

- August 2001, notification sent to federal, state, and local governmental agencies; national state, and local organizations and individual stakeholders regarding seashore PWC determination and requesting comments.

  - 89% of organizations responding supported the ban
  - 5% of organizations responding were against the ban
  - 6% had no opinion

- October 3, 2001, press release: "Public Meetings Concerning Closure of Cape Lookout National Seashore to Personal Watercraft (Jetskis, etc.)." Opens 30-day public comment period.

- October 3, 2001, web site posting: "Public Meetings Concerning Closure of Cape Lookout National Seashore to Personal Watercraft (Jetskis, etc.)." Opens 30-day public comment period.

- October 3, 2001, web site posting: "DRAFT Determination on Appropriateness of Personal Watercraft (PWC) Use at Cape Lookout National Seashore."

- August 28, 2001: letter to 85 Federal, State and local public agencies requesting comment on "DRAFT Determination on Appropriateness of Personal Watercraft (PWC) Use at Cape Lookout National Seashore."

- Public Meetings: October 25, 2001 and October 26, 2001, 12:00 P.M. to 2:00 P.M. and 7:00 P.M. to 9:00 P.M.

- March 12, 2002, public comment tally (includes emails, letters and petitions from individuals) — 5,694 comments received by the park.

  - For PWC Ban: 4,591 (81%)
  - Against PWC Ban: 1,103 (19%)

- April 12, 2002, comment tally from organizations and government agencies — 100 additional comments received.

  - For PWC Ban: 89 (89%)
  - Against PWC Ban: 5 (5%)
  - No Opinion 6 (6%)

EA CONSULTATION

- *November 19–21, 2002*: internal scoping conducted at the national seashore headquarters to identify issues, impact topics, objectives, preliminary alternatives, and public participation related to development of the PWC EA.

- *February 11, 2003*: park continues to receive emails on a regular basis with respect to the PWC closure. These new comments have not been tabulated since March 12, 2002.

- *March 21, 2003*: park prepares internal scoping report for development of PWC EA.

- *April 8, 2003,* press release: "Cape Lookout National Seashore Schedules Public Meetings to Consider Alternatives for Use of Personal Watercraft."

- *May 2003, newsletter*: National seashore prepares and publishes "Personal Watercraft Use Scoping Brochure" describing the purpose and need, objectives, and preliminary alternatives, as well as announcing public meetings held in May.

- *May 7, 2003 and May 8, 2003, public meetings*: Two public meetings were held to consider use of PWC within seashore boundaries.

- August 2004, publication of second newsletter explaining status of environmental assessment.

- The park continues to occasionally receive emails with respect to the PWC closure and EA process.

CONSULTATION WITH OTHER AGENCIES

Request for consultation letters have been sent to the U.S. Fish and Wildlife Service and the State Historic Preservation Office. No comments have been received to date.

The distribution list for this document includes federal, state, and local agencies as well as adjacent landowners, interest groups, and the public at large.

Reviewing Agencies for the Environmental Assessment

The following agencies, groups, and organizations were sent requests for consultation, or expressed interest in the document, and will receive a copy of this environmental assessment. Additional businesses and individuals not included on this list will also be sent a copy of the document due to expressed interest.

Federal Agencies

Department of the Interior
Fish and Wildlife Service
SERO Public Affairs, National Park Service

US Army
Corps of Engineers

U.S. House of Representatives
Cong. Walter B. Jones and Jean Preston

U.S. Senate
Senators Elizabeth Dole, John Edwards, and Scott Thomas

U.S. Coast Guard
Don Rose, Fort Macon

State Agencies

Division of Coastal Management
Fort Macon State Park
North Carolina Coastal Federation
North Carolina Coastal Reserve
North Carolina Division of Marine Fisheries
North Carolina Office of the Lt. Governor
North Carolina Shore and Beach Preservation
North Carolina State Department of Cultural Resources
North Carolina Wildlife Federation
North Carolina Wildlife Resources Commission
State Historic Preservation Officer

Local and Regional Agencies

City of Swansboro
Mayor

City of Pine Knoll Shores
Joan Lamsen

Cateret County
Board of Commissioners
Chamber of Commerce

County Manager
Economic Development Council

Town of Oak Island
Town Manager

Organizations and Businesses

Alger Willis Fishing Camps, Inc.
Anderson Maritime, Inc.
Audubon North Carolina
Barrier Island Kayaks
Biodiversity Legal Foundation
Bluewater Network
Boy Scouts of America
Calico Jacks Ferry
Cape Lookout Environmental Education Center
Cape Lookout Mobile Sportsfisherman
Cape Lookout Studies Program
Carolina Estuarine Reserve Foundation
Carolina Ocean Studies
Carteret Community College
Coastwalk
Core Banks Surf Fishing Club
Core Sound Kayaks and Touring Co.
Core Waterfowl Museum
Crystal Coast Tourism Development Authority
Davis Island Fishing Foundation
Downeast Business Association
Downtown Morehead City Revitalization Association
Duke Marine Lab
Environmental Defense
Foundation for Shackleford Horses, Inc.
Friends of Cape Lookout National Seashore
Good Fortune Sail Charters
Harkers Island Fishing Center
Hotel/Motel Association (Atlantic Beach)
Island Ferry Adventures
Local Yokel Ferry and Tours
Lookout Cruises
Morris Marina Kabin Kamps and Ferry Service, Inc.
Mystery Tours
National Parks & Conservation Association
Natural Trails and Water Coalition

New Hope Audubon Society
North Carolina Aquarium at Pine Knoll Shores
North Carolina Maritime Museum
North Carolina Outward Bound
North Carolina Outward Bound School
North Carolina Sea Grant, NCSU
North Carolina Sierra Club
Outer Banks Ferry
Outer Banks Preservation Association
Outer Island Kayak Adventures
Personal Watercraft Industry Association
Pro Canoe and Kayak Outdoors
Save Our State
The History Place
The Nature Conservancy
The Wilderness Society
University of North Carolina at Chapel Hill
US Power Squadron
Waterfront Ferry Service, Inc.
Wildlands Center for Preventing Roads

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APPENDIX A: APPROACH TO EVALUATING SURFACE WATER QUALITY IMPACTS

Objective

Using simplifying assumptions, estimate the minimum (threshold) volume of water in a waterbody below which concentrations of gasoline constituents from PWC or outboards would be potentially toxic to aquatic organisms or humans. Using the estimated threshold volumes, and applying knowledge about the characteristics of the receiving waterbody and the chemical in question, estimate if any areas within the waterbody of interest may present unacceptable risks to human health or the environment.

Overall Approach

Following are the basic steps in evaluating the degree of impact a waterbody (or portion of a waterbody) would experience based on an exceedance of water quality standards / toxicity benchmarks for PWC- and outboard-related contaminants.

1. Determine concentrations of polycyclic aromatic hydrocarbons (PAHs), benzene, and methyl tertiary-butyl ether (MTBE) in gasoline (convert from weight percent to mg/L, as needed) and PAHs in exhaust. The half-life of benzene in water is 5 hours at 25°C (Verschuren 1983; EPA 2001b).

2. Estimate loading of PAHs, benzene, and MTBE for various appropriate PWC-hour levels of use for one day (mg/day)

3. Find/estimate ecological and human health toxicity benchmarks (risk-based concentrations [RBCs]) (micrograms [ug]/L) for PAHs, benzene, and MTBE.

4. Divide the estimated loading for each constituent (ug) by a toxicity benchmark (ug/L) to determine the waterbody threshold volume (L) below which toxic effects may occur (convert liters to acre-feet).

Estimated hydrocarbon (HC) emissions from PWC and outboards will be significantly reduced in the near future, based on regulations issued by the EPA and the CARB.

Assumptions and Constants

Several assumptions must be made in order to estimate waterbody threshold volumes for each HC evaluated. Each park should have park-specific information that can be used to modify these assumptions or to qualitatively assess impacts in light of park-specific conditions of mixing, stratification, etc. and the characteristics of the chemicals themselves. The assumptions are as follows:

- BTEX (benzene, toluene, ethyl benzene, and xylene) are volatile and do not stay in the water column for long periods of time. Because benzene is a recognized human carcinogen, it is retained for the example calculations below and should be considered in each environmental assessment or environmental impact statement (Verschuren 1983; EPA 2001b).

- MTBE volatilizes slightly and is soluble in water. MTBE may accumulate in water from day to day, but this is not factored into the calculation and should be considered qualitatively in the assessment.

- PAHs volatilize slightly (depending on structure and molecule size) and may adhere to sediment and settle out of the water column or float to the surface and be photo-oxidized. They may accumulate in water from day to day, but this is not factored into the calculation and should be considered qualitatively in the assessment.

- The toxicity of several PAHs increases (by several orders of magnitude) when the PAHs are exposed to sunlight. This was not incorporated because site-specific water transparency is not known, and should be discussed qualitatively.

- The threshold volume of water will mix vertically and aerially with contiguous waters to some extent, but the amount of this mixing will vary from park to park and location to location in the lake, reservoir, river, etc. Therefore, although the threshold volume calculation assumes no mixing with waters outside the "boundary" of the threshold volume of water, this should be discussed in the assessment after the threshold volume is calculated. The presence or absence of a thermocline should also be addressed.

- Volume of the waterbody, or portion thereof, is estimated by the area multiplied times the average depth.

In addition to these assumptions, several constants required to make the calculations were compiled from literature and agency announcements. Gasoline concentrations are provided for benzene, MTBE and those PAHs for which concentrations were available in the literature. Constants used are:

- Gasoline emission rate for two-stroke PWC: 3 gal/hour at full throttle (CARB 1998)

- Gasoline emission rate for two-stroke outboards: estimated at approximately the same as for PWC. Gasoline emission rate for four-stroke inboards estimated at 10% of that of two-stroke outboards.

- 1 gallon = 3.78 liters

- Specific gravity of gasoline: 739 g/L

- 1 acre-foot = 1.234×10^6 L

- Concentration of benzo(a)pyrene (B[a]P) in gasoline: up to 2.8 mg/kg (or 2.07 mg/L) (Gustafson et al. 1997)

- Concentration of naphthalene in gasoline: 0.5% or 0.5 g/100 g (or 3,695 mg/L) (Gustafson et al. 1997)

- Concentration of 1-methyl naphthalene in gasoline: 0.78% or 0.78 g/100 g (or approx. 5,760 mg/L) (estimated from Gustafson et al. 1997)

- Concentration of benzene in gasoline: 2.5% or 2.5 g/100 g (or 1.85×10^4 mg/L) (Hamilton 1996)

- Concentration of MTBE in premium gasoline (octane of 90 and higher) in North Carolina: 3.1%, or 3.1 g/100 g (Cheryl Dickson, TRW Petroleum Technologies, pers. comm. 4/29/2003).

- Estimated emission of B(a)P in exhaust: 1080 ug/hr (from White and Carroll 1998, using weighted average B(a)P emissions from two-cylinder, carbureted two-stroke liquid cooled snow mobile engine using gasoline and oil injected Arctic Extreme injection oil, 24-38:1 fuel:oil ratio. Weighted average based on percentage of time engine was in five modes of operation, from full throttle to idle).

- Estimated amount of B(a)P exhaust emissions retained in water phase = approximately 40% (based on value for B(a)P from Hare and Springier, quoted in North American Lake Management Society 2001).

Toxicity Benchmarks

A key part of the estimations is the water quality criterion, standard, or toxicological benchmark for each contaminant evaluated. There are no EPA water quality criteria for the protection of aquatic life for the PWC-related contaminants (EPA 1999a). There are, however, a limited number of EPA criteria for the protection of human health (via ingestion of water and aquatic organisms or ingestion of aquatic organisms only). Chronic ecotoxicological and human health benchmarks for contaminants were acquired from various sources.

Ecological benchmarks for benzo(a)pyrene, naphthalene, and benzene are from *Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Revision* (Suter and Tsao 1996). The ecological benchmarks for benzo(a)pyrene (0.014 ug/L) and benzene (130 ug/L) are Tier II Secondary Chronic Values in table 1 of Suter and Tsao (1996), which were calculated using methods in the Great Lakes Water Quality Initiative (EPA 1993). The ecological benchmark for naphthalene (62 ug/L) is the EPA Region 4 chronic screening value (table 3 of Suter and Tsao 1996). This screening value was chosen for use as a conservative mid-range value considering the wide range of chronic values for naphthalene (12–620 ug/L) shown in Suter and Tsao (1996). The ecological benchmark for 1-methyl naphthalene (19 ug/L) is based on the LC_{50} value of 1900 ug/L for the Dungeness crab (*Cancer magister*), a marine invertebrate (USFWS 1987). The MTBE benchmark of 18,000 is for marine waters, and is based on the preliminary chronic water quality criteria presented in Mancini et al. (2002). The human health benchmarks for benzo(a)pyrene (0.018 ug/L) and benzene (51 ug/L) are human health criteria for the consumption of aquatic organisms (EPA 2002b). Following are the default toxicity benchmarks for the PAHs, benzene, and MTBE having gasoline concentration information:

Chemical	Ecotoxicological Benchmark (μg/L)	Source	Human Health Benchmark (μg/L)	Source
Benzo(a)pyrene	0.014	Suter & Tsao 1996	0.018	EPA 2002
Naphthalene	62	Suter & Tsao 1996	—	—
1-methyl naphthalene	19	USFWS 2000	—	—
Benzene	130	Suter & Tsao 1996	51	EPA 2002
MTBE	18,000	Mancini et al. 2002	—	—

Example Calculations

Calculations of an example set of waterbody volume thresholds are provided below for the chemicals listed above together with their concentrations in gasoline and available toxicity benchmarks.

Loading to Water. Loadings of the five contaminants listed above are calculated for one day assuming 10 PWC operate for four hours (40 PWC-hours), each discharging 11.34 L gasoline per hour and having concentrations in fuel or exhaust as listed.

Benzo(a)pyrene (from the fuel): 40 PWC-hrs × 11.34 L gas/hr × 2.07 mg/L = 939 mg

Benzo(a)pyrene (from the gas exhaust): 40 PWC-hrs × 1080 ug/hr × 1/1000 mg/ug × 0.40 = 17 mg

Total B(a)P = 956 mg

Naphthalene: 40 PWC-hrs × 11.34 L gas/hr × 3695 mg/L = 1.68×10^6 mg

1-methyl naphthalene: 40 PWC-hrs × 11.34 L gas/hr × 5764 mg/L = 2.62×10^6 mg

Benzene: 40 PWC-hrs × 11.34 L gas/hr × 1.85×10^4 mg/L = 8.39×10^6 mg

MTBE: 40 PWC-hrs × 11.34 L gas/hr × 2.57×10^4 mg/L = 1.16×10^7 mg

Loadings of contaminants from two-stroke outboards should be estimated based on the estimated loading based on the horsepower of the outboards involved (see "Assumptions and Constants" above) and the estimated hours of use, based on the types of boats and the pattern of use observed.

Threshold Volumes. Threshold volumes of water (volume at which a PWC- or outboard-related contaminant would equal the benchmarks listed above) are calculated by dividing the estimated daily loadings (mg of contaminant) for the number of operational hours (e.g., 40 PWC-hours) by the listed toxicity benchmark concentrations (ug/L), correcting for units (1 mg = 10^3 ug), and converting from liters to acre-feet (1 acre-foot = 1.234×10^6 L):

Protection of Aquatic Organisms.

Benzo(a)pyrene: 956 mg B(a)P × 10^3 ug/mg / 0.014 ug/L = 6.8×10^7 L or 55 ac-ft

Naphthalene: 1.68×10^6 mg naphthalene × 10^3 ug/mg / 62 ug/L = 2.71×10^7 L or 52 ac-ft

1-methyl naphthalene: 2.62×10^6 mg 1-methyl naphthalene × 10^3 ug/mg / 19 ug/L = 1.38×10^7 L or 112 ac-ft

Benzene: 8.39×10^6 mg benzene × 10^3 ug/mg / 130 ug/L = 6.45×10^7 L or 52 ac-ft

MTBE: 1.16×10^7 mg MTBE × 10^3 ug/mg / 18,000 ug/L = 6.44×10^5 L or 0.52 ac-ft

Based on these estimates and assumptions, 1-methyl naphthalene appears to be the contaminant (of those analyzed) that would be the first to accumulate to concentrations potentially toxic to marine organisms (i.e., it requires more water [112 ac-ft] to dilute the contaminant loading to a concentration below the toxicity benchmark). The threshold volumes are very similar for benzo(a)pyrene, naphthalene and benzene.

Protection of Human Health.

Benzo(a)pyrene: 956 mg B(a)P × 10^3 ug/mg / 0.018 ug/L = 5.31 × 10^7L or 43 ac-ft

Benzene: 8.39 × 10^6 mg benzene × 10^3 ug/mg / 51 ug/L = 1.64 × 10^8 L or 133 ac-ft

Based on human health water quality criteria for ingestion of aquatic organisms, benzene would be the first PWC-related contaminant in these example calculations that would reach unacceptable levels in surface water (133 ac-ft); however, volatilization of benzene from water to air was not included in the calculation. Benzo(a)pyrene would be the second PWC-related contaminant to reach unacceptable concentrations in surface waters (43 ac-ft).

As a result of the estimated reductions in HC emissions (from the unburned fuel) in response to EPA regulations (listed above), additional PWC and/or outboards may be used in the parks without additional impacts on water quality. For example, based on the expected overall reductions from EPA (1996a, 1997), up to twice the current number of PWC /outboards may be used in a given area in 2012 without additional impacts on water quality over current levels. Effects on noise levels, physical disturbance, or hydrocarbon emissions that are products of combustion (e.g., B[a]P) may not be similarly ameliorated by the reduced emission regulations.

Application of Approach

Use of the approach described above for evaluating possible exceedance of standards or other benchmarks must be adapted to the unique scenarios presented by each park, PWC use, and waterbody being evaluated.

Factors that would affect the concentration of the contaminants in water must be discussed in light of the park-specific conditions. These factors include varying formulations of gasoline (especially for MTBE); dilution due to mixing (e.g., influence of the thermocline), wind, currents, and flushing; plus loss of the chemical due to volatilization to the atmosphere (Henry's Law constants can help to predict volatilization to air; see Yaws et al. 1993); adsorption to sediments and organic particles in the water column (e.g., PAHs), oxidation, and biodegradation (breakdown by bacteria). Toxicity of phototoxic PAHs may be of concern in more clear waters, but not in very turbid waters.

The chemical composition of gasoline will vary by source of crude oil, refinery, and distillation batch. No two gasolines will have the exact same chemical composition. For example, B(a)P concentrations may range from 0.19 to 2.8 mg/kg, and benzene concentrations may range from 0% to 7% (2% to 3% is typical). MTBE concentrations will vary from state to state and season to season, with concentrations ranging from 0% to 15%. The composition of gasoline exhaust is dependent on the chemical composition of the gasoline and engine operating conditions (i.e., temperature, rpms, and oxygen intake). If site-specific information is available on gasoline and exhaust constituents, they should be considered in the site-specific evaluation. If additional information on the toxicity of gasoline constituents (e.g., MTBE) becomes available, they should be considered in the site-specific evaluation.

Pollutant Concentrations Reported in Water

Pollutant	Source(s)	Levels Found	
		"Lower Use" (e.g., open water, offshore locations; reduced motorized watercraft use)	**"Higher Use" (e.g., nearshore, motorized watercraft activity high)**
Benzene	*Lake Tahoe Motorized Watercraft Report;* several studies reported		
	1. U.S. Geological Survey	1. <0.032 µg/l	1. 0.13 – 0.33 µg/l
	2. Miller and Fiore	2. ≤0.3 µg/l	2. just over 1 µg/l
	3. University of California	3. <0.1 µg/l	3. 0.1 – 0.9 µg/l
PAH	A. Mastran et al.	A. All below detection limits (<0.1 µg/l for pyrene and naphthalene; <2.5 µg/l for B(a)P, B(a)A, chrysene)	A. Total PAH – up to 4.12 µg/l in water column; total PAH – up to 18.86 µg/l in surface sample at marina, with naphthalene at 1 µg/l; B(a)P – ≥2.3 µg/l
	B. Ortis et al.	B. Experiment #1 – 2.8 ng/l phototoxic PAH	B. Experiment #1 – ± 45 ng/l phototoxic PAH; 5–70 ng/L total PAH
MTBE	A. *Lake Tahoe Motorized Watercraft Report;* several studies reported		
	1. U.S. Geological Survey	1. 0.11–0.51 µg/l	1. 0.3–4.2 µg/l
	2. Miller and Fiore	2. ≤3 µg/l	2. 20 µg/l (up to approx. 31 µg/l)
	3. University of California	3. less than nearshore area	3. up to 3.77 µg/l
	4. University of Nevada – Fallen Leaf Lake	4. —	4. 0.7–1.5 µg/l
	5. Donner Lake (Reuter et al. 1998)	5. <0.1 µg/l	5. up to 12 µg/l (Dramatic increase from 2 to 12 µg/l from July 4 to 7)
	B. NPS, VanMouwerik and Hagemann 1999		
	6. Lake Perris	6. 8 µg/l (winter)	6. up to 25 µg/l
	7. Shasta Lake		7. 9–88 µg/l over Labor Day weekend
	8. Three-day Jet Ski event		8. 50–60 µg/l
	9. Lake Tahoe		9. often within range of 20–25 µg/l, with max of 47 µg/l

As the nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering wise use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historic places, and providing for the enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people. The department also promotes the goals of the Take Pride in America campaign by encouraging stewardship and citizen responsibility for the public lands and promoting citizen participation in their care. The department also has a major responsibility for Native American Indian reservation communities and for people who live in island territories under U.S. administration.

NPS (December 2004)